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ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

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"Fox III" icebound in Arsuk fiord, Greenland, near the world's only cryolite mine at Ivigtut

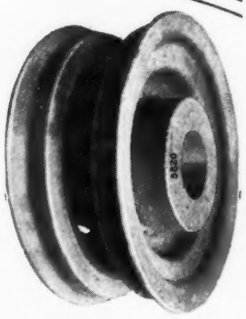
Mining Cryolite in Greenland
By Samuel G. Gordon

Surveying Oil Wells With Anderson Apparatus
By F. M. Smith

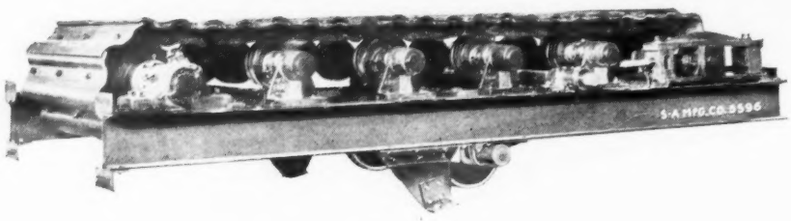
The Market Report

Statistics of Metal Prices and Production

New Machinery



This photo shows the big, rugged rollers which carry the weight of the loaded feeder. They outwear a dozen of the numerous small rollers often used in this type of equipment.



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Volume 121 February 6, 1926 *Number* 6

ENGINEERING AND MINING JOURNAL-PRESS

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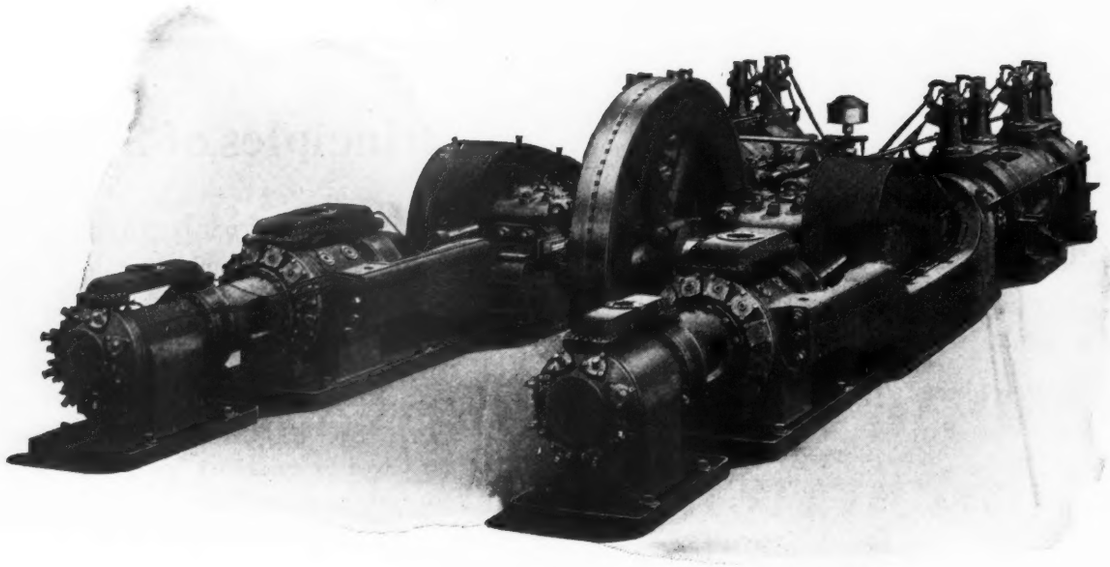

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 121 New York, February 6, 1926 *Number* 6

Another Copper Producer Makes Its Bow

A MONTH FROM NOW, if recent expectations are fulfilled, another important copper producer will begin adding a substantial tonnage to the world's supply of that useful and, as some think, too freely available metal. Bwana M'Kubwa is not nearly so well known as Katanga: it is a more recent and smaller development, and it has a name that is more awkward and harder to pronounce than the euphonious appellation of its big neighbor a hundred miles or so to the northwest; but it seems destined to become one of the important mines of the world.

A copper mine in the interior of Africa is not so attractive as one in Utah or Arizona, or even in Chile. The ore occurrences at Bwana M'Kubwa have been known for many years, but no continuous effort was made to develop the possibilities of the region until recently. The present owners are said to have secured the property for £50,000, after £200,000 in all had been spent on it. In the last two or three years efforts to find more ore have been more successful, and now the reserves are said to be between seven and eight million tons, averaging about 4 per cent copper. It is hoped that the N'Kana mineralized vein may be found to extend over a length of 3½ miles, in which event the present ore reserves will be comparatively insignificant. The new treatment plant, which is expected to go into operation about March 1, will handle about 1,000 tons a day, though it is expected to increase this to 2,000 tons before long, and later, with planned extensions, to 3,000 tons if the development of the mine warrants it.

The copper minerals are oxidized in the upper levels, and will be mined by open-cut methods down to about 270 ft., costs being about 1s. 8d. per cubic yard; below that, working through shafts will be more expensive. At 500 ft. there is a free flow of water, and below that the minerals are sulphides.

The treatment process to be used is one developed by the Minerals Separation company, and for that reason is supposed by many to be a form of the flotation process. It is entirely different, however, as T. A. Rickard explained in the Nov. 28 issue of *Mining Journal-Press*. The copper silicates are first broken down at a dull red heat to the oxide, producer gas then being brought in contact with the hot ore to effect a partial reduction to a spongy metal state. Ammonium carbonate solution is then used for leaching, and the copper precipitated by driving off the ammonia, which is regenerated. Thus Walter G. Perkins, who has developed the process, has borrowed liberally from the work of C. Harry Benedict, of the Calumet & Hecla, and of W. J. Cayzer, of Kennecott, the only other places in the world where ammonia leaching has been developed in an important commercial way. It is altogether probable that these companies have freely released their operating data; in fact many of the details of their metallurgical practice have been published, and it is to be hoped as a result that the officials of foreign mining companies will be influenced to adopt a more liberal policy regarding their own metallurgical operations.

Bwana M'Kubwa expects to be able to deliver copper in London for about 10c. per pound, in a form that is almost if not quite as pure as that which has been electrolytically refined. Though the operations just beginning will produce only about 22,000,000 lb. of copper per year, which is a little more than Katanga produces in a month, nevertheless this is only a beginning. The newcomer will be, next to Granby, the most important copper producer in the British Empire, and is, next to Rio Tinto, the most important British-controlled copper company in the world.

Dominion of and by Petroleum

THE STATUS of Americans in petroleum developments of Europe and Asia is discussed in a paper by John Wellington Finch in the *Bulletin* of the American Association of Petroleum Geologists. After reviewing field by field the principal petroleum provinces of the regions under discussion—regions whose petroleum resources have played a major rôle in world politics and in the news since and even during the World War—Mr. Finch succinctly observes: "It is interesting to note how little share we, a nation largely responsible for the creation of the petroleum industry and leaders at all times in the development of its technology, have had in these important foreign operations, and what little chance we have for a future position in them." For this result two reasons occur to Mr. Finch: first, that American capital has been busy developing the internal resources of the United States, and has thereby become isolated in spirit and tradition, while British capital has long since been forced to seek and find its investments anywhere in the world. The risks involved by American capital in developing internal resources, moreover, have been less than those involved in foreign enterprises, so that the spirit of the American entrepreneur in distant lands has not been so highly developed by experience as that of the British investor.

The second reason which Mr. Finch finds is that American foreign business lacks effective government support. His conclusions are worth quoting more fully: "It has been the general aim of our Department of State in the past to protect life rather than property. The policy of isolation advocated by Washington has never been fully abandoned. Though the attitude of our government in the matter of foreign relations has been gradually changing of late years, the change is probably coming too late to help us establish any commanding position in foreign oil fields except in North and South America. Even in the latter country our English friends are strong competitors. At best our government is not so constituted that it can maintain an institution of the nature of the British Foreign Office, with its uninterrupted performance under skilled and experienced guidance, with its vast volume of constantly accumulating facts, assembled by trained men and always available to those seriously contemplating

foreign ventures, and with its eternal vigilance in the fostering of British trade and industries in foreign places, and the protection of them with gunboats and armies, if need be."

Mr. Finch's second reason, it may be remarked, is included in or is part of the first. The vast field of enterprise for American capital in North America, and more recently in South America, has not only kept capital relatively uninterested in the risks of more distant and highly competitive fields of investment—and this is true not only of petroleum but of rubber and many other things—but it has kept the government of the United States in a similar contented and reluctant attitude; so that if an American company should desire to adventure widely and competitively abroad, it meets but scant sympathy from the government or the public. It is not so long since that an American Secretary of State—no other than William J. Bryan—was reported to have remarked that American investors in Mexico, whom he pictured as representing capital predatory upon the Mexican people, need expect no sympathy or assistance from the government.

Mr. Finch's concluding paragraph, again, deserves to be quoted in full and to be editorially underwritten: "To sum up, excepting in Rumania, where they were established years ago and are now in jeopardy, American interests have no position in the major European or Asiatic oil fields, unless, in one or possibly two regions, as shareholders or in association with English companies. Great Britain will be in a few years the leading petroleum-producing nation in the world, and will be selling us oil. It has taken to heart the lesson of the Great War, before which its oil resources were inadequate for national defense, and acted upon this lesson with promptness and magnificent efficiency."

The United States in general, public and government, including the Secretary of Commerce, may therefore contemplate future profitable markets for Great Britain in the United States not only for rubber and diamonds, but for petroleum, which is a thousand times more important than all the rest put together. Meanwhile, however, this is a certain number of years off, and it is not the training of the United States to indulge in commercial prevision and provision. The status, as scheduled by Mr. Finch (and before him, by many others, including the writer of many editorials in this journal) appears to be a *fait accompli*, in spite of the false complacency and assurances of the American Petroleum Institute as to the "limitless resources" of the United States. Being thus settled, the future should not be viewed with alarm. When the control of petroleum passes from the United States, it could be inherited by no better successor than its sister English-speaking nation. Indeed, in this as well as in other commercial and political questions, the isolation of the United States is no longer desirable or possible, and co-operation, rather than a defensive and offensive attitude, will be most beneficial.

Cryolite at Ivigtut

A PROPERTY that comparatively few engineers have visited is the cryolite mine at Ivigtut, in southern Greenland. Considerable interest attaches to this deposit of sodium aluminum fluoride by reason of the fact that of this mineral it is the world's only known commercial source.

There are three reasons why Ivigtut is rarely visited: Greenland is a "closed" country, and no one is allowed to go there without special permission from the Danish Government; the region is remote and its approaches are inhospitable; and there is little to attract any great number of visitors thither, so far as explorers have discovered. The country is huge—as large as the United States east of the Mississippi—and mostly covered with an ice sheet of great area and thickness. A visit made three years ago to Ivigtut for the Academy of Sciences of Philadelphia is described by Samuel G. Gordon in this issue. Those who would like to see this arctic camp, but cannot, may thus view it through another's eyes.

Cryolite is required in the process of reducing aluminum from bauxite, being the principal constituent of the electrolytic bath which is used to dissolve the alumina. It is also used for various other less important purposes. According to R. M. Anderson, the high price of natural cryolite has led to the production of the synthetic compound, and the artificial product is now being used to a considerable extent in aluminum manufacture. It is said to be more easily decomposed by the electric current than the natural mineral, but is now preferred in practice. If this is the case, it is likely that the natural mineral, which must be mined in such a distant place as Ivigtut, and transported through such difficult waters, will more and more give place to artificial cryolite.

Shall the Shareholder Be Disfranchised?

A TENDENCY of modern corporate organization is the creation of two classes of common stock between which the only substantial difference is that one class carries voting power and the other does not. A typical case is that of Dodge Brothers, Inc. The public has invested in the enterprise to the extent of $155,000,000, but the control of the business is vested in Dillon, Read & Co., bankers and promoters, by virtue of the ownership, in its entirety, of a small issue of class "B" common shares. These alone have voting power. An arrangement of this kind has been made recently in a number of other instances. Though no large corporation engaged in mining is so constituted, it is quite possible that, if the practice becomes general, reorganizations may be effected whereby banking interests will offer voteless shares in mining enterprises to the public. As in the case with Dodge Brothers, the investor need not, of course, buy the securities; but, judging from experience, shares will find wide distribution, with or without voting power, if they are offered by big financial houses.

The principle of separating ownership from responsible control has been criticized recently by Prof. William Z. Ripley, of Harvard. In defending the so-called Dodge plan, financiers say that the inside controlling group merely is accepting openly the responsibility for the management that it always has exercised, anyway, because of the apathy of the average stockholder. They argue that, as the small shareholders seldom, if ever, exercise their voting privilege, it is better to take it away from them. The contention that the mere knowledge that the stockholders have the right to vote them out of office is an effective deterrent to maladministration is answered by this argument: If the utmost publicity is given to the affairs of a corporation, mismanagement will cause the public promptly to sell its shares, thereby depressing the market for the shares and consequently seriously injuring the credit of the corporation. It is argued that this is a more potent

corrective to possible incompetency or dishonesty on the part of the bankers or others in control than the voting power of the real owners. This reasoning will not be convincing to everyone. The question will be asked, why should not both safeguards be provided, even if one is seldom used? Rather inconsistently advocates of the new plan contend, further, that the bankers are likely to be hampered in their administration of company affairs if they are subject even to the potential restraint of a vote of stockholders.

The New York *World* points out a deeper and more fundamental significance that is worthy of consideration. It says:

"When the supporters of the new fashion argue as they do they lay the existing industrial system open to very radical attack. If it is true that the owners of industry are quite incapable not only of managing industry but even of holding the managers of industry accountable for results, then the private ownership of industrial property has lost the chief justification claimed for it during the last 150 years. It has always been asserted that the interest of the owner of property was the best public guarantee of the wise social use of his property. Now it is argued that the owner is necessarily both ignorant and impotent and that he ought to be disfranchised completely.

"This argument says in effect that the owner of property is nothing and can be nothing but a money-lender, that he cannot protect himself, that as an owner he has no responsibility to the consumer and to the employee. This is dangerous doctrine to come out of Wall Street. For surely if that is where our corporate system has evolved, then the defenses are down against those who will argue that private industry, like public utilities, must be strictly regulated by the Government. The acknowledgment that private industrial property ownership is irresponsible and impotent can lead sooner or later only to a régime of state socialism. For of one thing Wall Street may be certain: No civilized people will in the long run intrust dictatorial control of great corporations to the personality of private bankers and the accidents of mortality. The stewardship of large property, whatever form it takes, will have to be publicly accountable.

"Believing as we do that the extension of governmental control is dangerous both to government and to liberty, we cannot look with complacency upon a fashion in finance which leads so logically and so straight to state socialism."

All may not agree with the implications in this quotation, but the matter is of such importance that it cannot be ignored on the ground that it is academic. Already the New York Stock Exchange has taken cognizance of the problem and has gone so far as to say that the share structure of a corporation in this respect will be scrutinized carefully before listing privileges will be granted.

Another Mining Method Patented

A PATENT on a mining method arouses curiosity because it is so unusual. Comparatively few have ever been taken out. A mining method is something that develops slowly. Its details are often borrowed or adapted from current or abandoned practice. From its very nature it is generally common knowledge in the district where it is developed, as it is almost impossible to keep the details secret. It would be difficult to prove or disprove that an alleged new method were really new instead of being a resurrection or modification of something discontinued elsewhere. Where the application of machinery, of new design perhaps, is an essential feature, the novelty can be more readily demonstrated, but even here the chances of being able to secure a patent are dubious, unless one gambles on the ignorance of the examiner in the Patent Office. For this reason every patent granted is worth consideration.

Two applicants in Ishpeming, Mich., on the Marquette iron range, have just received a patent on a method of mechanical mucking, by which the ore is shoveled and moved from breast to chute by means of a "shovel-skip" suspended from a carriage running on an overhead track, which in turn is suspended from the "roof-supporting" timbers. The skip is moved vertically and horizontally by means of a hoisting and traverse cable and operated by a power unit likewise carried suspended from the track. Further details are needed to discern the advantages of the method. Let it suffice that it is patented. May it profit the inventors!

Lead Into Mercury?

IT IS REPORTED that in laboratory experiments (but on an insignificant scale quantitatively, and without economic importance) lead has been changed to mercury and thallium by two professors of the University of Amsterdam. This has been announced to The Associated Press through the *Scientific American*. The experiments were made with a quartz mercury vapor lamp, the same device which was formerly used by German and by Japanese scientists in the experiments which led to the announcement of the transmutation of mercury into gold. This transmutation was also widely press-agented by the *Scientific American* as being the experiment which proved the transmutation of metals, but the *Scientific American's* own investigation demonstrated that the claim was an error. After so may false claims, the alleged transformation of lead into mercury will properly be regarded with great caution. In any case, it is not correct to advertise it to the public in such phrases as "Transmutation of Metals, Long Aim of Chemists, Carried Out in Dutch Laboratory," as one newspaper does. Transmutation has long been an established fact, since the discovery that radium breaks down into a variety of elements, including helium, uranium, and lead. Science should be made popular, but its presentation should be kept scrupulously accurate; and the reports of its progress should not be distorted with the aim of journalistic sensationalism.

Visitors From Abroad

ENGINEERS FROM ABROAD are frequent callers at the offices of the *Mining Journal-Press*. They include the foreign visitor, who at times requires the services of an interpreter, and the American who has just returned from work in distant countries. In one day recently there came a Japanese engineer inquiring as to methods of mining petroleum in Alsace; a Berliner, interested in geophysical methods of prospecting; a South American engineer from Venezuela; an American, who had just returned from Bolivia; another just back from Mexico; and still another who was just about to leave for Dutch Guiana—all this not an unusual occurrence. In the course of a year travelers from most of the mining countries of the earth find their way, for a few minutes' chat at least, into the editorial offices.

The natural growth of the *Mining Journal-Press* has been in the direction of a constantly widening international circulation. In this find their reflection the peregrinations of the American engineer and the flow of capital into mining enterprises in foreign countries, as well as the many interests which mining men of all countries have in common.

Photo by Mr. Gordon, Courtesy of The National Geographic Society

An eider duck's eye view of Ivigtut, looking east

The Inland Ice of Greenland is just beyond the distant mountain range. The entire settlement is shown in this picture, scattered about the mine. Four piles of cryolite can by seen on the embankment awaiting a vessel.

peaks, with here and there a glimpse of the inland ice, contrasted brilliantly with the gleaming white icebergs in the dark-blue waters of the strait. To the northwest of Cape Desolation is a bold island peak, Unanak—the woman—marking the approach to the Arsuk fiord. In the evening, the "Lom" entered the fiord and anchored at the foot of the towering peak of Kingnait, rising more than 5,000 ft. above the water's edge. Natives from the near-by village of Arsuk soon visited the ship to offer strings of salmon in trade. Then rounding a bold precipice, a tiny village on the south side of the fiord, almost lost among the surrounding mountains, comes into view. This is Ivigtut, the site of the only cryolite mine in the world. The officials of the Danish Government and of the company operating the property soon came on board, and indicated an anchorage, for the fiord is so deep that anchoring places are few.

Ivigtut, the Mining Village

Separated from the fiord by but 50 ft. of embankment is a long deep quarry—the cryolite mine. About 150 men are employed at Ivigtut during the summer, and less than half that number remain during the winter.

Early in the spring, the "Fox III," a stanch 600-ton wooden vessel, arrives, although much of the fiord is still frozen. Daily the little colony has been listening for its whistle before it rounds the point, bringing the first mail for more than four months, newspapers, magazines, and fresh food supplies.

Spring is usually cold, with much rain, but the sun rises higher and higher each day. With the doubling of the number of workmen, Ivigtut becomes extremely busy, mining sufficient cryolite for the twelve or thirteen small vessels that call from Copenhagen and Philadelphia in the short summer season.

Midsummer is very delightful; areas along the small streams behind the village become green with copses of juniper, blueberry, crowberry, dwarf birches, and willows; the ledges of rocks become carpeted with moss, with occasional blooms of the arctic poppy, the blue willow herb, and the yellow saxifrage. However, swarms of mosquitos serve to take some of the joy out of life.

The workmen live on the southwest side of the mine and the officials on the northeast side. The latter, with great patience, have constructed a tennis court by filling in the spaces between the boulders of gneiss with dump material, and topping it with fine cryolite. On a huge rock, an attractive little summer house has been built, in which the players congregate for the Danish 9 o'clock tea.

With the coming of autumn, the blueberry leaves assume a scarlet hue, vividly coloring the patches of vegetation on the ledges of the cliffs. The mountains abound in ptarmigan and arctic hare, which are hunted by the men on holidays. Occasionally the Greenlanders (natives) will bring in some reindeer meat. At the end of October, thin ice begins to form in the fiord; the days become shorter and shorter. Clocks are changed repeatedly; daylight is "saved" to the limit.

In November, the "Fox III" reappears, the first boat to arrive in the spring, and the last to leave in the fall. Supplies have been brought for the men who are to stay over the winter. A little over half the workmen—those who have spent the last year and a half at Ivigtut—now look forward to their return to Denmark. At the end of November the "Fox III" weighs anchor, and with a parting whistle dips its flag and passes down the fiord.

After the middle of December, the sun is seen no more at the village, as it does not rise above the sur-

Mining Cryolite in Greenland*

World's Only Commercial Source of This Mineral, at Ivigtut, Entirely Under Danish Control—Production in 1924 Was 23,700 Tons—Deposit Discovered in 1806

By Samuel G. Gordon
Academy of Natural Sciences of Philadelphia, Pa.

Samuel G. Gordon

GREENLAND is comparable in size to the United States east of the Mississippi. Practically all of the area of the country, however, is covered with a great sheet of ice, thousands of feet thick, rising to a dome over 8,000 ft. in altitude. Along the west coast is a strip of ice-free land, a rugged, mountainous mass, cut by wide and deep fiords. Numerous islands and skerries lie offshore. At the head of most of the fiords are glaciers debouching from the inland ice, and filling the water with great icebergs. In addition, the polar currents sweep down the east coast, and, rounding Cape Farewell, turn up the west coast, carrying along the field ice of the frozen polar sea. Persistent fogs add to the treachery of the offshore rocks, and the icebergs are an additional menace to navigation. Davis Strait commands the respect of all mariners; at times it is quite calm, but usually its seas are heavy, and water frequently cascades over the forecastle onto the decks of vessels.

The entire population of Greenland is about 14,000, chiefly Eskimos with some European blood, all known as Greenlanders. They live in villages of 75 to 500 on the west coast, close to the sea, from which much of their food is obtained. A single village, Angmagssalik, is situated on the east coast.

The Danish Government has so actively encouraged arctic exploration that more is now known regarding Greenland than of any other northern land. Reports detailing the results of these explorations have been published in more than sixty volumes,[1] and the entire coast has been mapped, although not in detail. The general geology of much of the ice-free area of the country has been studied.

On the occasion of my visit which offered opportunity to gather the data here presented, the "Lom," a Norwegian vessel of 2,000 tons on which I had taken passage, moved up and down Davis Strait, steering in and out among great icebergs, waiting for the fog to lift, revealing the mountainous coast of Greenland, aptly named by Davis the Land of Desolation. Jagged alpine

*Through the courtesy of the Danish Government, Mr. Gordon in 1923 visited the Julianehaab district of Greenland, this being the second of the Academy's three mineralogical expeditions. An opportunity was thus given to inspect the cryolite mine.

[1]Technical references will be found at the end of the article, on page 240.

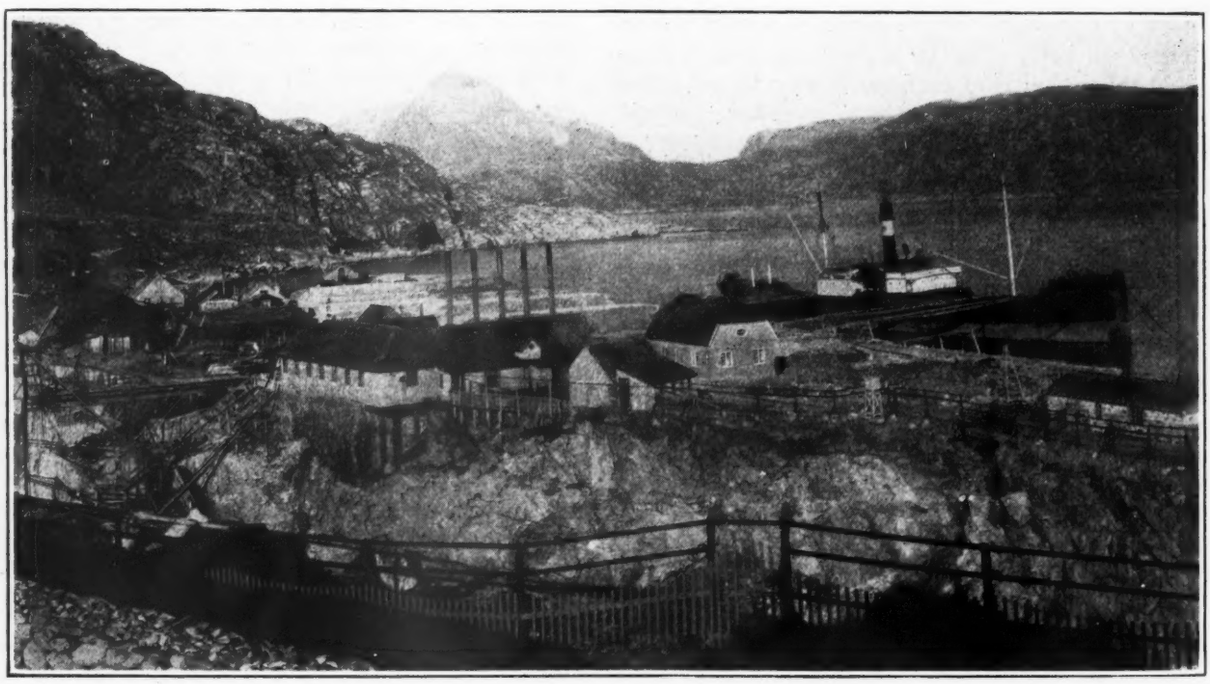

Photo by Mr. Gordon, Courtesy of The National Geographic Society

The cryolite mine at Ivigtut, on the Arsuk fiord. Kingnait Mountain is in the distance. Beyond the mountain lies Davis Strait

Note the temporary wooden bridges between the shore and the vessel, the piles of cryolite ready for loading, and the hoist at the extreme left.

When a vessel arrives, wooden bridges are placed between the shore and the deck to facilitate loading. A number of men shovel the cryolite into wheelbarrows, walk up one bridge, dump the cryolite into the hold as they pass, and leave by the adjoining bridge. The clatter of wooden shoes lasts for three days, when the parade ceases, and the men return to the mine to await another ship.

Geology and Mineralogy of the Cryolite Deposit

Ivigtut and the surrounding district is underlain by granitic and hornblendic gneisses, presumably of Pre-Cambrian age. These gneisses are cut by many dikes of diabase. Farther up the fiord, about three miles east of the mine, is an intrusive mass of nepheline syenite: a fine-grained aggregate of orthoclase, nepheline, aegirite, with some mica, sodalite, and chlorite.[6]

The cryolite deposit, associated with much pegmatitic material, lies entirely within a small intrusive mass of porphyritic granite. According to Johnstrup[7] the cryolite body is inclosed within a discontinuous peripheral mass of pegmatite.

A fine-grained, pink, porphyritic granite, composed of quartz, orthoclase phenocrysts, and some biotite, is the mother rock of the cryolite deposit. The orthoclase phenocrysts are flesh-colored, and may attain a length of one centimeter. Under the microscope they show Carlsbad twinning and some cloudiness due to alteration.

Along the northwest wall, some fragments of altered granite may be seen in the cryolite. These xenoliths are angular masses usually more than 30 cm. long. The surface of the xenoliths is studded with small quartz crystals up to 2 cm. in length, projecting into the surrounding cryolite. The granite of these xenoliths is green, and consists entirely of quartz and sericite. All of the feldspar of the granite has been altered to sericitic aggregates. A similar greenish altered granite was seen in the floor of the quarry at the southeastern corner, indicating that the bottom of the deposit has been reached.

The best exposure of a typical pegmatite is in the southern wall, in the granite overlying the cryolite mass. Specimens of graphic granite may be gathered in which the graphic intergrowth consists of microcline and cryolite. The original quartz of the graphic intergrowth has been replaced by cryolite. Some galena is occasionally found associated with this secondary cryolite.

Wolframite, tantalite, allanite, cassiterite, and arsenopyrite were found in veins of milky quartz associated with typical pegmatitic material.

There is nothing in the main cryolite mass, except some occasional garnet, that would suggest a pegmatitic origin. The cryolite body consists largely of pure massive cleavable cryolite, Na_3AlF_6. It is usually white, but when it incloses garnet it is black and radioactive. The cryolite at times contains large crystals of cryolithionite, $Na_3Li_3Al_2F_{12}$, which are difficult to distinguish from the cryolite.

Associated minerals are principally quartz, siderite, argentiferous galena, sphalerite, auriferous chalcopyrite, and pyrite. Sulphides of these minerals occur in small amount throughout the deposit. The siderite occurs as perfect brown rhombs up to a decimeter in size; locally it may be very abundant. Quartz forms small crystals or masses within the cryolite. Thin sections of the quartz reveal that it contains many minute cavities filled with aqueous solutions, and CO_2, in both liquid and gaseous phases.

A number of rare fluorides: thomsenolite, pachnolite, ralstonite, and gearksutite, form druses of small crystals in fractures in the cryolite. Fluorite is not uncommon in veins.

The hoist at the cryolite mine. The ladder at the left is along a face of pure white cryolite

Exposed rocks are largely gneisses, schists, and crystalline limestones, supposed to be of Pre-Cambrian age, frequently cut by dikes of diabases. North of Disco Island the rocks are predominantly Tertiary basalt and andesite flows lying upon Cretaceous and Miocene sandstone, shale, and coal beds. In the Julianehaab district is an area of red sandstone of Devonian(?) age, into which have been intruded two batholiths of nepheline-syenite and associated alkaline rocks.

From a cursory examination of specimens and thin sections, I believe that the cryolite replaced an older mineral, perhaps albite; and that the siderite, sulphides, and quartz have been introduced at a later stage, replacing the cryolite.

In developing a theory of the origin of this unique deposit, the ideas of Cooke[8] and of Larsen and Schaller[9] are helpful. Cooke suggested that the emission of solutions from a cooling magma is constant, their escape being governed by accidental movements affording channels of flow; and, further, that the composition of the solutions depends on the stage reached in the crystallization or cooling of the igneous body at the time of escape.

rounding mountains. Gradually the arctic stillness steals over the country. Early snows bring out the men with their skis, as they delight in this sport. Slowly the fiord freezes over. Christmas is always gayly celebrated. Since my visit in 1923 a radio has been installed, and last Christmas a Scandinavian concert broadcast from Davenport, Iowa, was heard with great delight.

The northern lights (Aurora borealis) are of nightly occurrence, usually seen as slowly moving, long, greenish clouds, and occasionally as rapidly moving curtains of greenish, orange, pink, and reddish streamers. The winter snows pile up, and the north wind, with its icy blast, curtails all activity, shaking the houses, and causing their occupants to huddle about the stoves. In February the sun again appears above the mountains, and an occasional föhn wind indicates the coming of warmer days.

Discovery of the Cryolite Deposit

Cryolite was first brought to Europe by Danish missionaries who found the Eskimos using the mineral as weights on their fishing nets. The actual source of the cryolite was not known until the deposit was discovered by Giesecke. No story of the discovery of a mineral is attended with more romantic interest.

Sir Charles Lewis Giesecke, 1761-1833, (baptized Johann Georg Metzler) was the son of a Bavarian tailor. At that time mineral collecting was fashionable, and young Giesecke paid his way through college by selling mineral specimens. In 1806 he went to Greenland under the auspices of the Danish Government to examine the Frederick VII copper mines east of Julianehaab.[2] In September, 1806, he visited the Arsuk fiord, and found the cryolite deposit. He packed his specimens with moss in a number of old boxes and shipped them to Copenhagen. Later he returned to Gotthaab to await the boat that was to take him back to Europe. The Napoleonic wars, however, had begun, and it was seven years before another vessel reached Greenland. In the meantime, the boat containing his specimens suffered the fortunes of war. It was captured by a French privateer, and this in turn by an English frigate, and taken to Leith, Scotland. Fortunately, the boxes of specimens were stored in a warehouse for some time and later purchased for £40 by Allan and Collmrie, two Edinburgh mineralogists. They were delighted to find in them specimens of the highly prized cryolite, as well as a number of minerals then new to science: sodalite, eudialyte, arfvedsonite, allanite, and fergusonite.

Giesecke spent the seven years until 1813 exploring the various fiords from Upernivik in the north to Cape Farewell, even making one excursion up the ice-bound east coast, in the native sealskin boats. Upon his return to Europe he became professor of mineralogy in the University of Dublin. He was later knighted and otherwise highly honored.

Early Exploitation of the Deposit

Not until 1854, forty-six years after Giesecke's discovery of the deposit, was an attempt made to exploit it. J. W. Taylor, an English engineer, developed a small vein of argentiferous galena on the southeast side of the cryolite deposit.[3] In 1851, Julius Thomsen, of Copenhagen, discovered a method of extracting sodium aluminate from cryolite and demonstrated the suitability of the mineral and its products for enameling iron, soap making, and dyeing.[4] In 1854 he obtained the exclusive right to mine the cryolite at Ivigtut. The present operators, the "Aktieselskabet Kryolith-Mine-og Handelsselskabet," of Copenhagen, took over the property in 1865, and according to Ball,[5] their lease runs until about 1939. At the same time, the Pennsylvania Salt Co. obtained the exclusive right to the cryolite trade in North and South America.

About one-third of the cryolite now mined in Ivigtut is shipped to Philadelphia. Formerly the Pennsylvania Salt Co. maintained a fleet of small wooden sailing ships, the "Fluorine," "Chlorine," "Bromine," and others, which plied between Ivigtut and Philadelphia. Many of these were wrecked on the inhospitable Greenland coast. Now it is the practice to charter a 2,000-ton Norwegian iron steamship, which makes two or three trips in a summer.

The cryolite shipped to America is about 93 per cent pure and is inferior to the grades shipped to Copenhagen. About 2,000 tons of the cryolite shipped to America is used in making aluminum from bauxite, and the remainder for other purposes.

Mining Cryolite at Ivigtut

The mine is an open quarry about 500 ft. long, extending from northeast to southwest. The northeast end is about 60 ft. wide; toward the southwest the pit widens to about 160 ft. and deepens to about 150 ft. Originally the deposit was only exposed along the shore of the fiord at low tide. Extensive dumping and filling has built up an embankment, so that the pit is separated from the fiord by more than 50 ft. of embankment. On the northwest side of the pit an arm of cryolite extends toward the fiord, and this is the area now being exploited. At the bottom of the pit, ledges of green sericitized granite are exposed, indicating the approach to the bottom of the deposit.

A series of holes is drilled with air drills, and the blocks are shot down with black powder. The cryolite is hauled to a sorting platform, and water is thrown on it. The indices of refraction of cryolite are not far from that of water, and cryolite when wet, therefore, tends to become dull and less visible than quartz with much higher indices. The quartz can thus be readily separated by hand. The ore is hauled in a tram car to a hoist, sent to the top, and out to the stockpiles.

Years ago, when the pit was small, water was pumped into it in the fall. This prevented the filling of the pit with ice from freezing of rain water and seepage. Now, the pumps are kept going throughout the year.

Peculiar problems arise because of the isolation of Ivigtut and the fact that all labor must be imported from Denmark. The Danish Government does not permit the employment of natives. Last year a stone wall was built along the shore of the fiord, using rock that was shipped all the way from Sweden. Investigation showed that it would be cheaper to buy the stone already cut in Sweden, and ship it to Greenland, than to import labor to quarry it.

Practically all food supplies are obtained from Denmark. Some materials are obtained from America. Recently a house for the administrator and a large barn for a community house were purchased from a mail order house. A small amount of fish and game is purchased from the natives, and some cattle and sheep are obtained from Julianehaab, Narsak, and Igaliko, three places in South Greenland where it has been possible to grow grass and cure it for hay.

Larsen and Schaller in their study of the pegmatites of southern California have demonstrated that these assemblages have not arisen from the crystallization of an intruded "aqueo-igneous fusion," but represent a complex series of replacements. The original pegmatite consisted of typical graphic granite composed of microline and quartz, and even this quartz is regarded as a replacement of microcline. Solutions working through the graphic granite effected a replacement of the microcline by albite. Familiar beryl, tourmaline, and spodumene, which may occur in crystals of enormous dimensions, are still later replacements. The rubellite and lepidolite of the California pegmatites represented the last stage of a series of replacements; and they now occupy the space of the original graphic granite. A study of New England pegmatites has shown that this theory applies as well to that field. The theory should form a good working hypothesis for the study of the cryolite deposit at Ivigtut. The suggested history is: the intrusion of the graphic granite; replacement of the microcline by albite; replacement of the albite and perhaps also the quartz by cryolite, effected by fluorine-bearing solutions.

Perhaps at this stage was introduced the quartz veins containing wolframite, tantalite, allanite, and cassiterite. Later came the introduction of the quartz, siderite, and sulphides replacing the cryolite; and finally the formation of the druses of cryolite, pachnolite, thomsenolite, and ralstonite in fractures. Gearksutite may be a weathering product.

Cryolite has been reported in insignificant amount from but two other localities. It occurs in the pegmatite of a topaz mine near Miask, in the Ilmen Mountains, Siberia; and with pachnolite, thomsenolite, prosopite, and gearksutite in pegmatite north and west of St. Peter's Dome, at the southern base of Pike's Peak, in Colorado.

The mineral resources of Greenland have recently been summarized by Ball.[10] Glaciation has removed all superficial material, and the general lack of vegetation results in rock being exposed everywhere. In addition, the coast is so cut up with fiords that exploration has been relatively easy. The Greenlanders are keen observers, as is evidenced by the original discovery of the cryolite deposit and of the three meteorites in Melville Bay, which they used for making knives. They also exploited soapstone for making bowls and similar vessels and various rocks for hunting implements.

All the mineral deposits of western Greenland that are likely to be of economic value have probably been discovered and identified. They are few in number and will be briefly mentioned below.

First in importance is the cryolite deposit described herein. Persistent search has failed to reveal any other deposit of the mineral.

A number of occurrences of copper have been found, and two attempts have been made at exploitation: the Josvas copper mine, 22 miles south of Ivigtut, and the Frederick VII mine, 5 miles east of Julianehaab. The veins occur in granitic gneisses, but, being small, were soon exhausted.

Great masses of native iron have been found in the Miocene basalts and andesites of Disco Island, but these are more of scientific than of economic interest. Chromite occurs in dunite near Sukkertoppen and nickeliferous pyrrhotite in a dike of coarse olivine basalt on the north shore of Disco Island. Traces of gold have occasionally been found in some rocks, and galena and blende are not infrequently noted in minute quantity. Molybdenite, fergusonite, beryl, cordierite, tourmaline, amazonstone, rock crystal, and garnet occur in some granitic pegmatites, but never in commercial quantities.

Deposits of graphite are widely distributed, occurring in basalts, pegmatites, granitic gneisses, crystalline limestones, and graphitic schists. Some efforts have been made to exploit this mineral at Amitsok, 45 miles southeast of Julianehaab.

Extensive coal beds occur on Disco Island and in the vicinity of Nugsuak Peninsula. The beds range in age from Lower Cretaceous to Miocene, and form thin seams, usually under 1.5 ft. thick, and exceptionally up to 11 ft. The coal is chiefly lignite, but at the Colonial mine, at Kaersuarsuk, it is sub-bituminous. The small production is used in the various Greenland colonies.

In the alkaline syenites[11] about the Tunugdliarfik and Kangerdluarsuk fiords of the Julianehaab district the rare mineral eudialyte $Na_{12}(Ca, Fe)_6Cl(Si, Zr)_{20}O_{28}$ is of common occurrence, being disseminated through the rock, as well as forming veins. The mineral contains about 15 per cent ZrO_2, and a small quantity of Ce_2O_3. This district should become an important producer of this mineral if a use for it is ever discovered. It occurs in naujaite and kakortokites, extraordinarily attractive rocks, which would certainly be exploited for their beauty if they had been found in a less remote place.

Greenland is a "closed" country, under Danish rule. No one, not even a Dane, is permitted to go there except by special permission from the Danish Government. Ivigtut is the only European settlement in Greenland, and its inhabitants are not permitted to leave the vicinity of the mine. This restriction is not particularly onerous, as the nearest villages to Ivigtut are Arsuk, about 10 miles to the west; Kagsimiut, about 50 miles to the southeast; and Narssalik, even a greater distance to the northwest.

The Danish Government is paternalistically inclined, with the idea of Greenland for the Greenlanders. The country is largely supported by cryolite royalties, although some income is derived from the export of fox skins, seal skins (not from a fur seal, but a harp seal yielding a hide suitable for leather), and shark's livers, which are used for making a very fine oil.

Flour, coffee, tobacco, cotton and woolen goods, and other articles are sold to the natives at fixed prices, below those usually obtaining in Copenhagen. To some extent the natives have become so dependent upon the Danes for articles entering into their daily life that there is much less hunting and boat building than formerly.

Within the next two decades, if the cryolite deposit is exhausted, the Danish Government will be faced with a serious economic problem: that of sustaining the population of Greenland without the enormous cryolite royalties.

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Surveying Oil Wells With Anderson Apparatus

Ease and Accuracy Characterize the Work in Studying Three Different Type Problems—Fact of Extensive Lateral Drift in Deep Drilling Is Established

By F. M. Smith
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F. M. Smith

THE oil industry is a highly specialized branch of mining, and the development of new tools is constantly marking its progress. Survey apparatus developed by Alexander Anderson is probably the most highly technical tool which has ever been successfully run in an oil well. This apparatus itself, however, could not have been made a success without an oil well in which to run it. The Pan American Petroleum Co. of California paved the way for oil-well surveying in California when, through the courtesy of its president, J. C. Anderson, an oil well was furnished for the pioneer run.

It is outside of the scope of this article to describe in detail the invention either as to theory or methods. Any such description should rightfully come from the inventor himself. Suffice it to say that he has perfected an automatic means of recording by photography at successive stations the inclination from the vertical of an oil well, both in direction and amount. The survey is made in a round trip with the drill pipe at the rate of 1,000 ft. in one hour and ten minutes. Readings are taken at each stand length, and station distances are chained in on the drill pipe.

The accuracy with which angle data are recorded can be satisfactorily demonstrated through settings in a special frame designed for this purpose. These settings are made, and the inventor takes the instrument as if delivered from a well and interprets them. Interpretations will average within about seven minutes of being correct for vertical angles and within about thirty minutes in azimuth. In addition, the instrument is self-checking in that all recorded points must fall on a curve when plotted. Thus it can be seen that Mr. Anderson does not ask us to accept his apparatus on faith.

These notes describe well conditions under which our company made the first oil-well surveys in California. The wells which are described are three in number, and the surveys will be designated as Cases 1, 2, and 3. Being familiar with well conditions, it is not difficult to draw conclusions as to benefits upon a study of the traverses, which are tri-dimensional and are presented in plan and in elevation.

Case No. 1. Case No. 1 was an edge location in proven territory. Indeed, it was so much of an edge location that scouts and other company geologists commonly predicted that we would get nothing but edge water. The edge location of this well is important, when we consider possible returns to the company from survey data.

At the location in question a 15-in. rotary hole was drilled to a depth of 4,756 ft. through 597 ft. of 15½-in. conductor casing. Coring was started at a depth of about 3,200 ft., and seventy-one cores were taken before the bottom at 4,756 ft. was reached. With the bottom at 4,756 ft., the hole was bridged with cement from 3,250 ft. to 3,135 ft., and upper water was shut off by cementing 10-in. casing at 2,980 ft., which was just above the correlation for the top oil. After testing this horizon sufficiently to prove to our satisfaction that there was a small pumping well just below the 10-in. water string, it was decided to test the second horizon. The hole was cleaned out to a depth of 3,750 ft. and bridged with cement from 3,750 ft. back up to 3,460 ft., where a 6¼-in. water string was cemented to shut off an intermediate water. The hole was then cleaned out for a short distance below the 6¼-in. water string, and sufficient tests were made to prove that the second zone was wet and apparently no production was possible at this horizon.

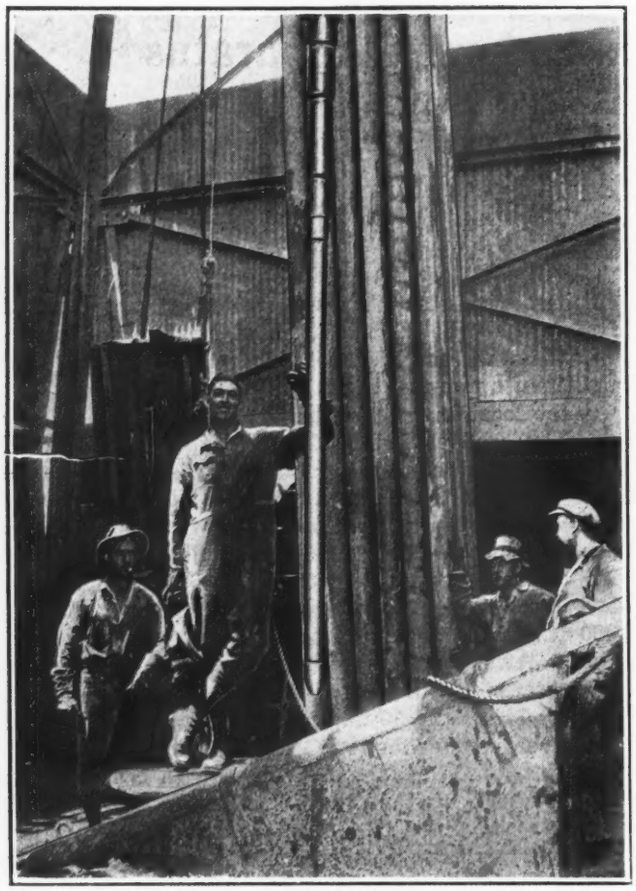
Survey Apparatus Lowered on Sand Line

Such was the condition of the well when the pioneer run was made with the Anderson survey apparatus. Up to a late hour it was expected to run the survey apparatus in the manner for which it was designed—that is, on drill pipe. Inadvertently the stands of drill pipe in the derrick were laid down and were not available for the run. The surveyor rose to the occasion, and the survey apparatus went into the hole on the end of a sand line.

In Mr. Anderson's sand-line method a set of expansible steel spring guides is run both above and below the instrument in its shell to prevent rotation in azimuth. A practically frictionless swivel connection is made from the end of the sand line to the instrument container. The survey went off on a time schedule, thirteen stations being chained in on the sand line.

The stations were at a distance of one string over the derrick, or 242 ft. apart, which put us 3,142 ft. into the hole. Thirteen vertical angles were recorded, varying from zero to a maximum of 10 deg. The film was quite distinct, and vertical angles ranging up to 10 deg. indicated quite clearly to what extent a rotary hole might drift from a plumb line. The total surveyed drift was 142 ft. at a depth of 3,142 ft.

The chief return to the company from a survey of Case 1 has to do with its edge location. The location stake was driven on the surface at what appeared to be the very outside possibility for production. Tests on the upper zone indicated a small pumper, while the second horizon gave water. Obviously, if rotary



Anderson oil-well survey apparatus about to be lowered in hole, with stands of drill pipe set back in the derrick

The mechanism is contained in a steel shell three-sixteenths of an inch thick, tightly sealed by welding. The driller, a Texan 6 ft. 4 in. tall, standing alongside, serves as a means of comparison as to size. The photograph was taken at the time of the survey described in the text as Case 3

holes drifted as suspected, the surveyed location of the intersection of the hole with the oil zones was a matter of the gravest importance.

The survey established the fact that the hole had drifted extensively. As subsequent events developed, the fact that the hole drifted made no difference in the handling of this particular well. However, there is an undrilled location directly along the strike and adjacent to Case 1 on the same lease. When the time comes to drill this location, the stake can be driven with much more assurance and to better advantage because of the knowledge that there was an extensive drift in Case 1.

Well Deep in Case No. 2

Case No. 2. Case No. 2 was a wildcat about a mile ahead of production in a rapidly developing field in the Los Angeles basin. One of the chief characteristics of this particular field was the extreme depth at which production was sought. The extreme depth of the wells in this field is important when we consider the possible returns to the company.

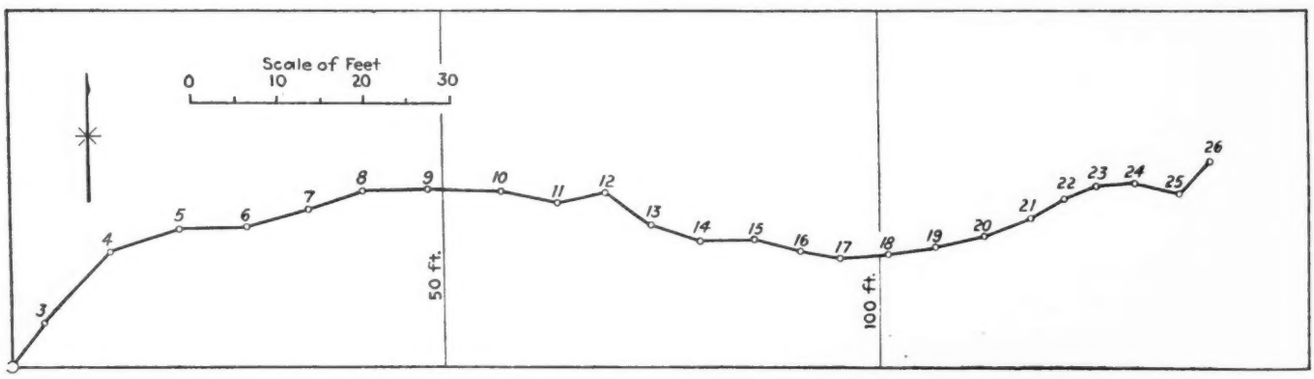
Drillers maintain that whether or not a hole is crooked will be one of the chief factors in deciding whether a rotary can reach a depth of 5,000 ft. or more. The engineer surveyor holds that all deep holes deflect from vertical and that the determining factor in deep drilling is the extent to which the holes are crooked.

At the location in question a 24-in. rotary hole was drilled to 695 ft. in three days, and 18-in. Hercules stovepipe casing was cemented for a conductor. The formation drilled through was comparatively hard, and the fact that it took only three days is mentioned, as it is believed to be important in view of subsequent developments. The orders to the drillers were "to set her on the bottom and twist her off."

After cementing the 18-in. stovepipe at 695 ft. the

Table I—Data of Survey of Rotary Drill Hole in Case 2

A Reading No.	B Depth Where Reading Was Taken, Feet	C Slope of Hole From Vertical	D Direction of Slope of Hole	E Lengths of Stands Drill Pipe, Feet	F Deviation per Stand in Feet
1	79.8	0 00	.....	79.8	0.00
2	167.9	0 00	.....	88.1	0.00
3	256.0	4° 00′	N. 36° 39′ E.	88.1	6.15
4	340.9	7° 50′	N. 43° 38′ E.	84.9	11.57
5	425.8	5° 50′	N. 72° 29′ E.	84.9	8.62
6	514.1	5° 00′	N. 88° 09′ E.	88.3	7.70
7	602.4	4° 50′	N. 74° 43′ E.	88.3	7.44
7½	.....	5° 00′	.....	.....	.....
8	690.3	4° 25′	N. 71° 54′ E.	87.9	6.76
8½	.....	4° 25′	.....	.....	.....
9	775.2	5° 00′	N. 87° 15′ E.	84.9	7.40
9½	.....	5° 25′	.....	.....	.....
10	857.1	6° 00′	S. 87° 52′ E.	81.9	8.56
10½	.....	5° 50′	.....	.....	.....
11	939.0	4° 40′	S. 78° 55′ E.	81.9	6.66
11½	.....	4° 50′	.....	.....	.....
12	1,020.9	4° 00′	N. 78° 34′ E.	81.9	5.71
13	1,106.4	4° 20′	S. 53° 53′ E.	85.5	6.46
14	1,191.9	4° 00′	S. 73° 06′ E.	85.5	5.96
15	1,277.4	4° 10′	N. 88° 53′ E.	85.5	6.21
16	1,362.9	3° 45′	S. 75° 06′ E.	85.5	5.59
17	1,448.4	3° 05′	S. 81° 41′ E.	85.5	4.60
18	1,533.9	3° 35′	N. 84° 52′ E.	85.5	5.34
19	1,619.4	3° 40′	N. 83° 11′ E.	85.5	5.47
20	1,704.9	3° 50′	N. 76° 08′ E.	85.5	5.72
21	1,790.4	4° 00′	N. 70° 01′ E.	85.5	5.96
22	1,875.9	3° 00′	N. 59° 53′ E.	85.5	4.47
23	1,961.4	2° 40′	N. 68° 36′ E.	85.5	3.98
24	2,046.9	3° 00′	N. 83° 57′ E.	85.5	4.47
25	2,132.4	3° 30′	S. 77° 28′ E.	85.5	5.22
26	2,217.9	3° 30′	N. 44° 33′ E.	85.5	5.22



Plan of rotary drill hole in Case 2. Pan American Petroleum Co. of California. Stations were taken one stand's length apart. The stands of drill pipe average between 80 and 85 ft. in length. Hence the station numbers on plans and sections show the number of stands in hole

hole was drilled ahead to 4,397 ft., using fishtail, disk, and rock bits and coring at 20-ft. intervals below 4,000 ft. The formation drilled through below 2,100 ft. was characterized chiefly by hard Fernando sandstones, and the drilling at all times was "hard digging." That the hole was crowded is evidenced by the occurrence of eleven "twist-offs" above a depth of 4,000 ft.

When a depth of 4,397 ft. was reached the 18-in. stovepipe conductor "went bad"—that is, it was worn to such an extent that it no longer functioned satisfactorily, and considerable trouble was caused by the drill pipe hanging up on running in and out of the hole. The particular point at which the bad conductor pipe gave the most trouble was at a depth of 246 ft. This fact is evidenced by a number of notations in the daily drilling reports to the effect that "the overshot stopped at 246 ft.," "drill pipe hangs up at 246 ft.," and the like. This is of interest when examining the survey, as the reader will note that the most pronounced crook shown by the survey is at 246 ft.

The bad condition of the 18-in. stovepipe was met by a decision to put in further conductor. Regular 15½-in. screw pipe would not go, and it was necessary to secure a special size in 14-in. Hercules stovepipe. Before running the 14-in. stovepipe the hole was bridged with a cement plug from 720 ft. up to 700 ft. This was probably unnecessary, but it was done and it shaped the future drilling history of the well.

Hole Lost at 720 Ft.

The new 14-in. conductor was landed on the cement bridge at 700 ft. and cemented with 250 sacks of cement. A few days later the cement plug was drilled out, and the bit, on reaching 720 ft., instead of dropping through into the old hole, continued to meet with resistance. Drilling continued to about 850 ft. before the drillers realized their predicament. They were making new hole, and some 4,400 ft. of the old hole was just out of their reach.

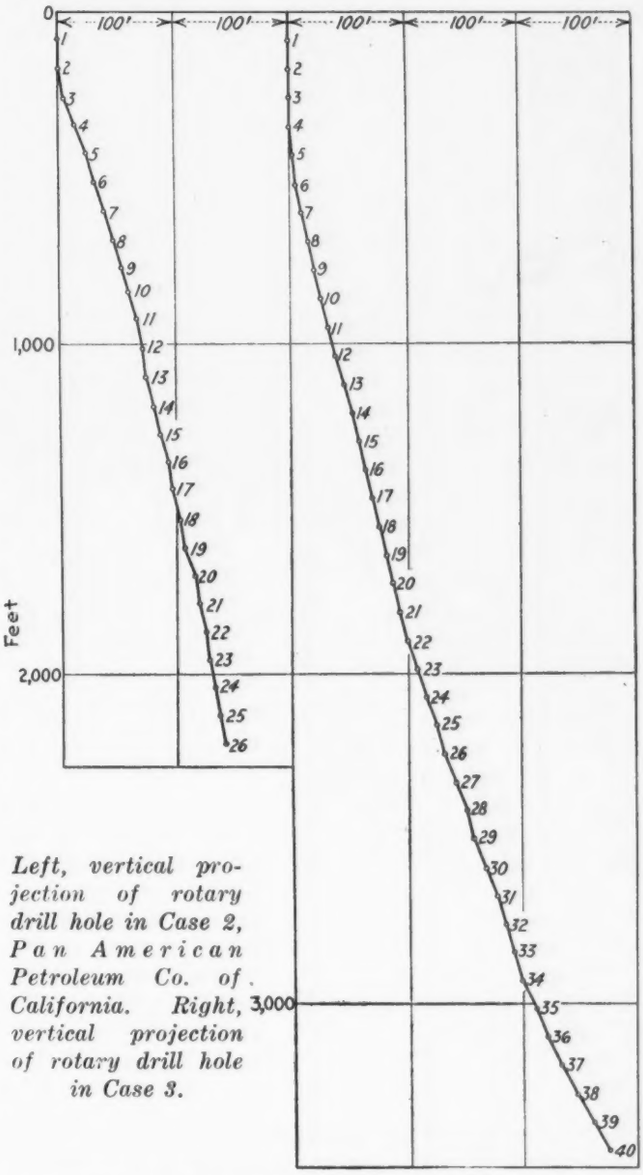
Following this, a period of about three weeks was taken up by attempts to get back into the old hole, efforts which grew more desperate as time progressed and their futility was borne in on all concerned. The 4,400 ft. of lost hole represented a loss of three months' time in a race with a competing company for flush production, in addition to an investment of several thousand dollars in drilling costs.

Every procedure which could be thought of and was at all feasible was tried. The second bore of the double-barreled hole was drilled to depths below 2,000 ft. in the hope of dropping into the first bore. The hole was thoroughly reamed and shot at the estimated point of divergence and slightly lower, in the hope of breaking the double bore together.

A twisted bit on the end of a bent "single" which would give a sweeping radius measured in feet when rapidly rotated was run for days at levels just above and below the entrance to the old bore. The second bore was plugged with cement and drilled out again on three separate occasions. On drilling out the cement, a 10-in. guide would be welded over the drill collar and lower portion of the 5-in. drill pipe to insure a straight course below the 14-in. conductor with its shoe at 700 ft. None of the attempts to retrieve produced results.

The situation was one which might well bring those in charge face to face with the desirability of knowing just where their hole went. In this particular case there was a handicap in not knowing the course of the lost hole if a survey of the second bore were made. In spite of this handicap a survey of the second bore was decided on, and Anderson's apparatus was run to a depth of 2,210 ft.

After surveying the hole we had definite evidence

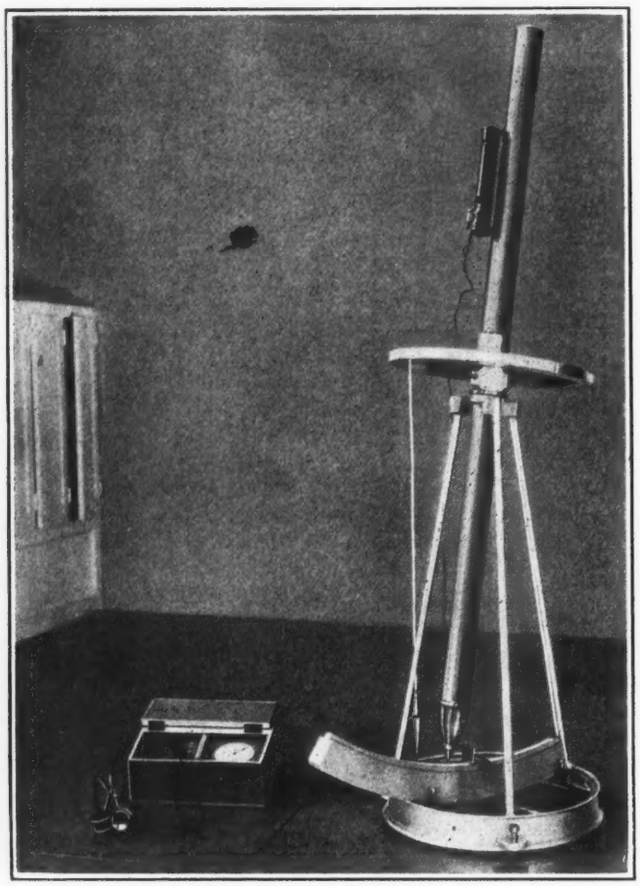


Left, vertical projection of rotary drill hole in Case 2, Pan American Petroleum Co. of California. Right, vertical projection of rotary drill hole in Case 3.

that the second bore was very straight in the region where the bit had gone astray. The fact that there were not any outstanding crooks in the critical region just below 700 ft. as shown by the survey which was run in the second bore drove home the conclusion that to have such a radical divergence the first hole must have been badly crooked. This conclusion seems in accordance with what was to be expected when we review the manner of drilling. The bit had been crowded ahead with all possible speed while drilling in hard formation.

Had the survey shown a suspicious-looking crook at a critical level it might have been assumed that the first hole was comparatively straight and that the divergence was due to a crook in the second hole. In such an event the lost hole might have been regained by plugging the crook with cement and then drilling out the cement with cable tools. As it was, the survey

held forth no hope that the hole which was lost would be found. Indeed, when we looked at the extent of the drift at 2,210 ft.—namely, a departure of 234 ft.—it appeared that by drilling ahead it was about as likely that we would drop into our competitor's hole as our own. After the survey but a few half-hearted attempts were made to regain the hole which was lost, and drilling was continued in the second bore to a depth of 3,945 ft.



Special demonstration frame mentioned in third paragraph of article with the machine set for certain inclination from the vertical

Note the footscrews for leveling the tripod, and the horizontal graduated circle and the vertical arc. The amplifier attachment and telephone receivers are for listening in on the mechanism and co-ordinating by stop watch with a time schedule on which shots are taken. Photograph by courtesy of the inventor, Alexander Anderson.

At 2,210 ft. the survey had shown us that in so far as a straight hole was concerned we were making a very poor start on a 5,000-ft. quest. At 3,945 ft. the drillers recognized from the derrick floor, to use their own expression, that the hole was as crooked as a dog's hind leg.

Difficulties in a Crooked Rotary Hole

A crooked rotary hole is like an over-heated automobile engine. The engine may function perfectly in every respect until overheated. Then numerous kindred troubles develop and overwhelm you. With the rotary, drilling goes fine in formation hard or soft as long as the hole is straight. Try to dig in a hole which has departed from the vertical in such a way that the driller can notice its crookedness. Your troubles will multiply and conditions get worse with depth. You will have cavey formation which will call for additional casing. When cased the conductor will wear out and give more trouble than would exist if it were not in the hole. The drill pipe will twist off and the fish will lie in difficult positions. In fact, a well with a poor start will give trouble through to the end.

As a sequel to the history of the well which was surveyed it may be noted with interest that when 3,945 ft. was reached the location was moved to a slightly more favorable position. Here a new well was spudded and word went out from the president that this well would be drilled right if he had to do it himself.

Considerable time was taken to set the conductor casing, and all efforts were concentrated upon a straight hole. The initial crook which Case No. 2 developed at 246 ft. was avoided. Therefore the 15½-in. conductor pipe up to the time of quitting the hole at 6,120 ft. did not wear so as to give trouble. The well was conspicuous for its absence of mechanical difficulties and broke several California drilling records. The only expenditure for casing in 6,120 ft. of hole was for the original 750 ft. of 15½-in. conductor.

The reader will agree without question that there were some practical advantages to be derived from the survey in the handling of Case No. 2. However, a statement that the deep test which followed Case No. 2 owed its success in hanging up records to the survey might be challenged. Nevertheless, the fact stands out that crooks and an excessive drift of the hole were brought to light and exposed by the survey. Immediately thereafter one of the very deep holes of the state was drilled with a minimum of trouble through concentrating on a policy of digging as straight as a rotary could dig. The same crews, the same equipment, and the same formation were present on both the success and the failure.

Scant Data for Case No. 3

Case No. 3. Case No. 3 was a wildcat which was drilled on data which was scant. Surface dips in three directions could be recognized, drilling costs were low, acreage was available, and a regional characteristic was the presence of gusher production at shallow depths where structure was proven. Possibility of a structure justified a test, and survey data in a hole which had not yet reached expensive proportions might either condemn or encourage the prospect.

Case No. 3 was spudded and drilled to 3,500 ft., taking cores at regular 20-ft. intervals below 500 ft. No showings of any kind had been encountered in the hole. Had the well come up to the regional description mentioned above, and assuming it was on structure, oil should have been present anywhere between 1,200 and 2,000 ft. The cores did show, however, numerous well-defined bedding planes which were at an apparent inclination of about 20 deg. with the axis of the cores.

The direction of dip as shown by the cores was a matter of importance. Pulling an oriented core was carefully considered. It appeared that in order to pull an oriented core and intelligently interpret the bedding planes the inclination of the hole must be known in direction and amount. On first reflection it will appear that the effect of inclination of the hole from vertical on dip would be such as either to increase or diminish the apparent dip according as the hole inclined with or against the strata. In the case of relatively flat dips even a reversal of direction might be involved.

However, the problem is more complex. By reflecting a little it will be realized that in dealing with apparent

dips as measured in a core we must apply the principles of descriptive geometry. The problem is one where we have given the intersection of a cylinder inclined at several degrees from the vertical with an inclined plane making a known angle of about 70 deg., in this case with the axis of the cylinder. Revolve the cylinder in such a way that its axis will generate a cone with the apex in the plane intersection.

It will be seen that a serious error of direction is introduced if the false assumption is made that the axis is vertical and the dip, or angle of maximum declivity, is measured accordingly in the plane of the intersection. The error will be reflected in recording the strike and the final calculated bearing based on false premises may easily be off as much as 45 deg.

This was first pointed out with reference to oil wells by Mr. Anderson, and it is only a matter of mathematics to prove that to draw intelligent conclusions from an oriented core it is necessary to know the inclination of the hole from vertical in direction and amount.

Decided to Pull an Oriented Core

The taking of an oriented core in Case No. 3, to be followed by a survey, was decided upon by Dana Hogan after consultation with the head of the company. The probable errors due to twist in the drill pipe when cutting the core and turning of the core on rotation planes within itself were fully realized. Errors due to the latter cause could be readily recognized in examining the core, and at any rate the results obtained would be relied upon only to the extent to which they checked with other data. Besides, some information about the direction of dip of the strata would probably be obtained from the direction of drift of the hole as shown by the survey.

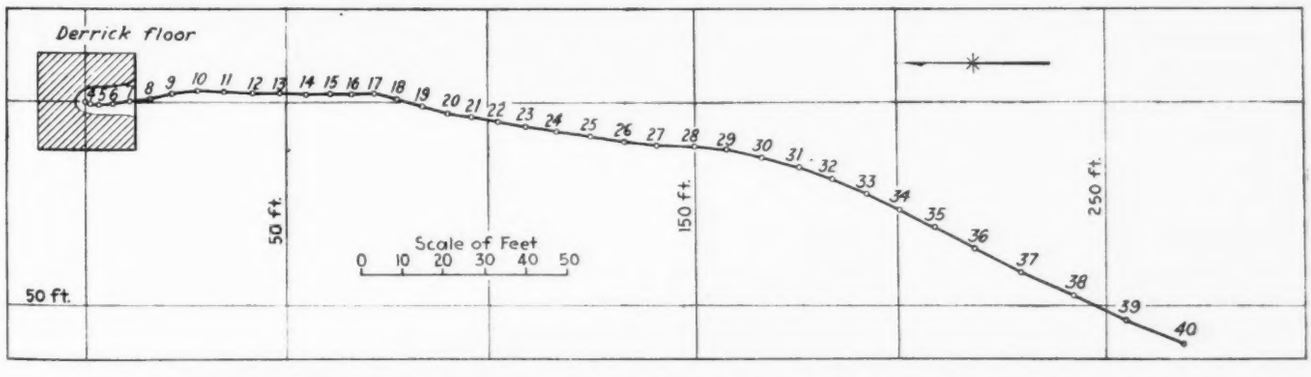
A 2-ft. core was carefully cut with an Elliott barrel and pulled, preserving its orientation by Mr. Anderson's methods. We were fortunate to find that the oriented core showed well-defined dips at the very bottom and below any apparent rotation plane. Twenty feet of hole was drilled ahead of the level where the core was cut and the survey apparatus run to the coring depth.

Table II—Data of Survey of Underground Course of Rotary Drill Hole in Case 3

A Reading No. (Stands of Pipe)	B Measured Depth	C Actual Vertical Depth	D Direction of Inclination of Hole	E Inclination of Hole from Vertical°	F Inclination Shown as Feet per 100
1	86.5	86.5	.....	0 00	.....
2	173.0	173.0	.....	0 00	.....
3	259.5	259.5	.....	0 00	.....
4	346.0	346.0	S. 28° 21′ W.	0° 34′	0.99
5	432.5	432.48	S. 9° 45′ W.	1° 20′	2.32
6	519.0	518.90	S. 3° 37′ E.	2° 31′	4.39
7	605.5	605.30	S. 8° 14′ E.	2° 41′	4.68
8	692.0	691.65	S. 8° 21′ E.	3° 22′	5.88
9	778.5	777.97	S. 13° — E.	3° 39′	6.37
10	865.0	864.22	S. 8° 03′ E.	4° 19′	7.51
11	951.5	950.47	S. 0° 57′ W.	4° 23′	7.65
12	1,038.0	1,036.68	S. 2° 01′ W.	4° 43′	8.22
13	1,124.5	1,122.92	S. 0° 57′ E.	4° 25′	7.69
14	1,211.0	1,209.16	S. 1° 44′ W.	4° 25′	7.70
15	1,297.5	1,295.46	S. 1° 16′ E.	3° 55′	6.82
16	1,384.0	1,381.80	S. 0° 37′ W.	3° 28′	6.03
17	1,470.5	1,468.11	S. 3° 45′ E.	3° 45′	6.53
18	1,557.0	1,554.41	S. 13° 52′ W.	3° 52′	6.75
19	1,643.5	1,640.66	S. 17° 56′ W.	4° 20′	7.55
20	1,730.0	1,726.92	S. 15° 18′ W.	4° 15′	7.41
21	1,816.5	1,813.21	S. 7° 25′ W.	4° 01′	6.99
22	1,903.0	1,899.47	S. 9° 03′ W.	4° 18′	7.50
23	1,989.5	1,985.69	S. 9° 17′ W.	4° 38′	8.09
24	2,076.0	2,071.85	S. 8° 37 W.	5° 05	8.88
25	2,162.5	2,157.91	S. 6° 24′ W.	5° 46′	10.06
26	2,249.0	2,244.02	S. 10° 05′ W.	5° 27′	9.50
27	2,335.5	2,330.13	S. 5° 46′ W.	5° 26′	9.45
28	2,422.0	2,416.15	S. 1° 38′ W.	6° 01′	10.48
29	2,508.5	2,502.28	S. 4° 45′ W.	5° 17′	9.21
30	2,595.0	2,588.30	S. 12° 48′ W.	6° 00′	10.44
31	2,681.5	2,674.28	S. 14° 23′ W.	6° 16′	10.92
32	2,768.0	2,760.37	S. 20° 06′ W.	5° 35′	9.72
33	2,854.5	2,846.37	S. 22° 23′ W.	6° 11′	10.77
34	2,941.0	2,932.41	S. 24° 52′ W.	5° 54′	10.28
35	3,027.5	3,018.37	S. 26° 08′ W.	6° 24′	11.16
36	3,114.0	3,104.12	S. 27° 43′ W.	7° 33′	13.12
37	3,200.5	3,189.70	S. 27° 08′ W.	8° 23′	14.57
38	3,281.0	3,275.03	S. 23° 38′ W.	9° 27′	16.40
39	3,373.5	3,360.35	S. 25° 56′ W.	9° 28′	16.44
40	3,460.0	3,445.51	S. 21° 42′ W.	10° 06′	17.54

wildcat at such a stage is left to the reader's own conclusions. The chief mechanical interest in the survey is that the hole appeared to be remarkably straight. This checked the fact that it gave little or no trouble in drilling. However, when drilling at 3,760 ft. the walls of the hole caved about 340 ft. below the derrick floor. There was no casing in the hole as yet, so 900 ft. of 12½-in. conductor was cemented.

After drilling through the conductor to a depth of 4,600 ft. the casing wore out and went bad. The exact depth at which it went bad was 338 ft. This is of interest because the survey shows that for the first four stands the hole was practically vertical. It is at a



Plan of underground course of rotary drill hole in Case 3. Pan American Petroleum Co. of California

Hole measures 3,460 ft. Vertical depth 3,445.5 ft. Horizontal drift is 276.8 ft. Direction of drift is S 12 deg. 8 min. W. Average deflection of hole is 4 deg. 35 min. (7.99 ft. per 100). Bottom of hole is inclined 10 deg. 6 min. (17.5 ft. per 100). Direction of inclination at bottom is S 21 deg. 42 min. W. Survey, instruments and methods by Alexander Anderson

The extent of the drift is shown by the blueprints. We were pleased to find that the direction of dip as taken from the core and corrected for inclination of the hole agreed with our preconceived ideas from other data. The well was continued, drilling for another 1,100 ft. after the survey.

The value to the company of such survey data in a depth of just about 338 ft. that the survey shows the first inclination of the hole to drift from the vertical.

Different Type Problem in Each Case

Cases 1, 2, and 3 represent three different type problems which were worked out to advantage. The problem involved in Case 1 is that of edge location.

It is common practice to drive the stake for such a well quite carefully. The matter of a few feet more or less farther out on the structure might influence the decision to drill. Thus a drift measured in hundreds of feet becomes a matter of first importance to the engineer and operator.

The lesson of Case 2 is chiefly mechanical, with consequent bearing on drilling costs. Casing is the big item on the balance sheets. If we do not wear out our conductor pipe we do not have to put so much casing in the hole. If it wears out and goes bad, due to excessive crooks which might have been straightened by reaming, other difficulties follow, and cost runs to prohibitive figures. It is clearly of advantage to recognize the crooks before reaching a decision to run the casing.

The problem of Case 3 is a geological one which is present in every wildcat. To draw correct conclusions from bedding planes in cores now only awaits the development of a successful "punch" core barrel where no torsional stresses will be set up in the cutting. It is not highly improbable that after data from a sufficient number of wells on proven structures are inspected, a law between direction of drift of the hole and dip of the strata will be apparent.

Method Assures High Degree of Accuracy

Problems of the three types which are discussed in these notes by no means limit the range for oil-well surveying. They merely constitute actual experience to date. The reasons for calling for a survey and the uses to which such data can be put appear to be many. Surveying itself has been accomplished with the facility of ordinary routine and an accuracy which approaches precision. The fact of extensive lateral drift in deep drilling has been established.

Other than the engineering features which have been partly covered in these notes, there is another important consideration to this recent development—namely, the legal aspect involved in lateral drift where town lotting is concerned. When boundaries are crossed it would appear that trespassing ensues. The tendency should be to consolidate in community leases with economically sound line agreements and consequent spacing. This would eliminate present extravagant overdrilling, resulting in direct benefit to legitimate operators and at the same time favor conservation of our natural resources in oil and gas.

Lead Mining Reviving in Tunisia

The lead and zinc mines of Tunisia are experiencing a revival, according to Leland L. Smith, in *Commerce Reports*. Stock quotations have risen for all important mines, and it is generally considered that the production will attain a high mark this year. Les Mines Reunies, the richest lead mine in Tunisia, is proving to be the equal of the famous Ouasta mine, in Algeria. It shipped 4,481 tons of lead ore during the first half of 1925.

Shipments made from the Algerian mine during the whole of 1924 amounted to 10,000 tons. Profits of the Mines Reunies reached 8,300,000 francs in 1924, and it is expected that this figure will be exceeded during 1925. Only 3,100,000 francs of indebtedness remain to be liquidated, and it is expected that this soon will be taken up.

Lead and Zinc Mines Important Factors in Eastern Canada

The Canada Department of Mines Geological Survey recently issued a statement with special reference to the lead and zinc mines of eastern Canada, in which it says that seldom or never has such interest been manifest in the economic possibilities of the occurrences of lead and zinc minerals in eastern Canada as has been shown recently. There are few known deposits that have not been the subject of close inquiry. On several old properties new options have been taken, and diamond-drilling and underground or surface work is being carried on. Development is also being done on a number of new deposits. Some of those now receiving attention give promise of developing into producing mines.

Nova Scotia

In Nova Scotia development work is progressing on the Stirling property, in the southeastern part of Cape Breton Island. The ore occurs in parallel bands in the rock. The mineralized zone has been traced on the surface for a length of 400 ft. and in one trench it has a width of 90 ft. A shaft is being sunk to a depth of 400 ft. alongside the main orebody by the American Cyanamid Co. of New York, and crosscuts are being run at various levels to tap the ore. A local company has also been formed to develop a deposit of galena at Smithfield, near Truro, Colchester County.

Quebec

In Quebec the only property producing zinc and lead is the Tetreault mine, at Notre Dame des Anges, Portneuf County. Work has here been carried to a depth of 500 ft. A somewhat similar deposit on Calumet Island has attracted renewed attention. During last year diamond-drilling operations were carried out on the Federal property, situated in the interior of Gaspe, 46 miles from the railway. A large number of veins have been opened up by surface trenching, and more than 2,000 ft. of drifting and crosscutting has been carried out. Zinc ore has been found in the Rouyn area, in western Quebec, associated with copper, and it appears most likely that zinc will be one of the products of the mining and smelting industry soon to be established in this part of the province.

Ontario

In Ontario the Kingdon mine, near Galetta, has been making a steady production of lead for several years. Work has progressed to a depth of over 1,000 ft. and for a length of over 2,000 ft. Options have been taken on a number of other galena-bearing veins in the Arnprior-Galetta area, and development work is being done on them.

The Frontenac lead mine, near Perth road, has recently been taken over with a view to working it. Near Renfrew, a deposit of zinc similar in many ways to that of Notre Dame des Anges is under development.

Extensive diamond-drilling operations have been conducted near Sudbury on a mineralized zone for the purpose of ascertaining the zinc possibilities. Near Geneva, in the same district, work has been performed on a new discovery of zinc. Interest was also taken during the last summer in the old Wright mine, on the east shore of Lake Timiskaming; in the Victoria and Cascade properties, near Sault Ste. Marie; and in the Jefferson mine, at Rush Lake, Genoa Township, in the Sudbury district.

Useful Operating Ideas

Ventilating Stopes and Winzes

By F. A. McLean

Ventilation of stopes, winzes, small prospects, shafts, or other workings not cleared by the ventilation system is sometimes a problem, as is also the case where it is impracticable to depend on the air currents set up by the exhaust from drills or to install rotary fans. In many mines it is customary to open air lines and use air at full line pressure to blow out smoke. This obviously wastes air and sometimes reduces pressure to a point where drills in other workings are handicapped.

A better and more efficient way of using compressed air for ventilation has been developed in several Australian mines where flat back stopes are in use. A small induction blower such as is used on rivet forges and steel-treating furnaces is the important feature. The induction blower has been on the market for three or four years and is intended to reduce the energy waste which occurs when forges are operated directly from high-pressure air lines. The cut shows a sectional view of the blower.

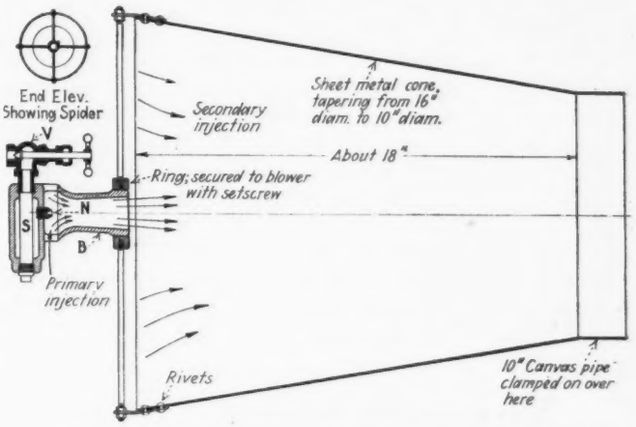
B is the blast tube with pipe thread for attaching to the forge or other device; *N* is the high-pressure jet nozzle with an orifice of proper size and shape; and *S* is a strainer which insures freedom from interruption by particles of dirt. The strainer is cleaned, without removal, by taking out the bottom plug and blowing air through it. *V* is the needle valve which regulates the air jet. In operation the compressed air issues from the nozzle at high velocity, and the energy due to its velocity is imparted to the surrounding air, which passes forward into the throat of the blast tube and is constantly replaced by additional free air flowing in at the bell-mouth openings of the blast tube. The efficiency of the device as given by manufacturer's rating is about 95 per cent, which signifies that 95 per cent of the air is induced and only 5 per cent (free air equivalent) is taken from the compressed-air line. Some idea of the air volume is given in the accompanying table, which represents tests made upon a small forge.

Result of Blower Tests

Cubic feet (free air) required	No. 1	No. 2	No. 3
Without blower	36.4	52.4	59.3
With blower	1.35	2.52	4.76
Draft in ash pit (inches of water)	0.35	0.70	1.35

A small rivet-heating forge requires an average of 45 cu.ft. of free air per minute. Directly taken from the compressed-air lines, this represents an expenditure of 7.5 hp. With the blower attachment, the consumption of air from the lines is less than 2 cu.ft. per minute (representing one-third of one horsepower) and the balance, or 43 cu.ft., per minute, is induced.

As used in Australia the blower is mounted in a spider so that the air from the blast tube is directed into the large end of a galvanized iron cone, as shown in the accompanying figure. The cone is 15 in. in diameter at the large end, about 18 in. long, and tapers to a diameter of 10 in. at the small end. A piece of 10-in. canvas tubing, with hoops at regular intervals to prevent collapse, is fitted to the small end of the cone and extends to the point where ventilation is required. The opening in the jet nozzle of the blower is enlarged from $\frac{1}{16}$ in., its normal diameter, to $\frac{1}{8}$ in., allowing a large volume of high-pressure air to pass through the blower, thus increasing the amount of induced air. Regulation of the amount of air delivered is obtained



Sectional view of induction blower used for secondary ventilation

by adjusting the needle valve. The arrangement has worked well with lengths of canvas tubing up to 40 ft. It is not expected to replace other methods of ventilation, but is suggested as an auxiliary to the regular equipment. The distance at which ventilation could be effected would depend largely on local conditions.

Determination of Zinc in Roasted Ore

By John H. Hastings

Chief Chemist, American Steel & Wire Co. Zinc Plant, Donora, Pa.

To ascertain the content of zinc in roasted ore, one-half gram of ore is weighed into a 250 c.c. beaker. The sample is wet down with water from a wash bottle and 15 c.c. hydrochloric acid added. The acid is evaporated to about 5 c.c. on the hot plate near the boiling point, but not boiled. Care is taken that it is not overheated, as zinc chloride is volatile above 125 deg. C. Seven grams of ammonium chloride and 200 c.c. of ammonia are added, and the beaker is filled half full of hot water. The solution is boiled five minutes and filtered through a No. 2 Whatman filter paper into a 400-c.c. beaker. The iron precipitate is washed ten times with a solution containing 100 gm. of ammonium chloride and 50 c.c. ammonia to the liter of water. A liter serves for twelve determinations. The solution is neutralized, using methyl orange as an indicator, with hydrochloric acid and 5 c.c. hydrochloric acid added in excess. The methyl orange color is taken out with a drop or two of bromine water. It is then boiled gently for fifteen minutes to get rid of oxydizing agents and

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief. Letters will not be printed unless the author's name and address are known to the editor.

Chlorine as a Magmatic Solvent for Metals

THE EDITOR:

Sir—Referring to the article by Horace E. Freeman and your article on "Alkaline Sulphides as Collectors of Metals," in the *Mining Journal-Press* of Dec. 19, you say that Mr. Freeman advises you that the reaction represented in the equation

$$Na_2S + H_2O + CO_2 = Na_2CO_3 + H_2S$$

is 100 per cent perfect in the presence of carbon dioxide. In that case sodium sulphide never exists in magmatic solutions, because all such solutions are derived from the condensation of volcanic gases, and such gases always contain carbon dioxide. There are about four thousand hot springs in Yellowstone Park, all of which are discharging magmatic waters, and I have yet to find where analysis shows one that contains sodium sulphide.

The salt waters which are found below the oil in oil wells are plainly magmatic in origin, as analyses show that they are entirely different from sea water, but these analyses, so far as my observation goes, do not show sodium sulphide, and in some cases the cuttings show the presence of the sulphides of iron, copper, lead, and zinc.

Chlorine unites with all the metals to form volatile chlorides, as shown by the process for extracting metals from these ores by roasting with salt. Chloride in a free state exists in volcanic gases, and rocks are many times more permeable by gases than solutions, so that it appears that it is far more probable that metallic chlorides are sublimed from the underlying igneous mass which contains the metals in traces only and that the sublimed chlorides are precipitated and concentrated as sulphides when the temperature has been reduced enough to allow of the condensation of steam to water.

As indicated by the presence of calcite and quartz in vein filling, the solutions were alkaline, for calcite would not have precipitated in an acid solution, and quartz is soluble in hot sodium hydroxide and precipitates from it on cooling. Under the conditions existing in the fractures opened by the pressure of the volcanic gas, the volatile chlorides would be in the presence of hydrogen sulphide resulting from the reaction

$$SO_2 + H_2O + 6H = H_2S + 3H_2O$$

Both the sulphur dioxide and hydrogen are shown in hot volcanic gases along with chlorine, so that as soon as the temperature is reduced to the condensing point of steam, hydrogen sulphide is formed, and not before.

Soda is present in all volcanic rocks, and in combination with water it renders a part of their silica soluble. The carbonic acid present in volcanic gases dissolves the calcium oxide and subsequently deposits it as calcium carbonate. The chlorine, when displaced by hydrogen sulphide, unites with the soda to form sodium chloride and either escapes to the surface or when trapped by an impervious shale cap over a fault plane collects in porous sandstone as the salt water below the oil pool.

All these various compounds, from natural gas through petroleum, salt water, and the sulphides of the metals, are segregates from the underlying magma which have come up along fault planes from the cooling interior.

Regarding your oft-repeated reference to the floating of fragments of wall rock by dense ore magmas, I will call your attention to the fact that reduced density produced by volcanic gases is the only force acting for either intrusion or extrusion. If, therefore, the magmas were dense enough to float wall rock, they would be too dense to have any ascensive force either to open fractures or fill them. It appears much more probable that the fragments found were blown out part way by the first rush of steam when the fractures were opened, in the same manner as millions of tons of volcanic ash and bombs are blown all the way out.

Cannes, France. HIRAM W. HIXON.

Replacement by Ores

THE EDITOR:

Sir—I have just read with much interest the articles on alkaline sulphides as collectors of metals in your issue of Dec. 19. You do not touch upon the rather important subject of replacement. Here in the Pine Creek portion of the Cœur d'Alene district we have ores that arrived at their present stage through a series of replacements of one element by another as the rocks cooled. First came quartz (probably deposited in the gelatinous form) and hornstone formed by alteration of the slate. This was followed by a "solution"—or whatever it was—that dissolved both hornstone and quartz more or less completely and left sphalerite mixed with about half its weight of galena. Next came galena to take the place of a small portion of the above-named mixture. Iron came at all stages, but was in the form of pyrrhotite at first and of pyrite only in the last. Thus the zonal theory applies in point of time rather than space.

The question is, does your dry sodium sulphide solution acquire a strong affinity for silica when it gets wet?

The formation of hornstone is hard to explain by the dry veindike theory. What was it that penetrated the microscopic openings between the laminations of the rather dense slate for distances up to 5 or 6 ft. from the fault fissure? It seems necessary to suppose that a gas or at least a very mobile liquid did it. The only obvious effect of this penetration was to convert the slates into a siliceous rock nearly as hard as quartzite. Perhaps water vapor helped this first reaction and was all driven out before the metallic minerals

titrated with potassium ferrocyanide, 1 c.c. of which is equal to 0.005 gram of zinc. A 5-per cent solution of uranium nitrate is used as an indicator on a paraffine spot plate. The end point is the first change of color to pink. Before titrating, 50 c.c. of a solution containing 10 gm. of sodium hyposulphite to the liter of cold water are added to the zinc solution. The solution is stirred vigorously and titrated slowly. The method follows the methods given in Low's "Technical Methods of Ore Analysis."

The potassium ferrocyanide solution is standardized by weighing 0.350 gm. of c.p. zinc into a 400-c.c. beaker. Ten cubic centimeters of water and 6 c.c. of hydrochloric acid are added, and the zinc is dissolved. Twenty-one grams of ammonium chloride are added, and the solution is made up to 250 c.c. with hot water, after which it is boiled for fifteen minutes and titrated as for ores. The same condition as to amount of ammonium chloride in solution, acidity, and the temperature and volume is maintained in the standard as in the ore determination. The standards are run in duplicates. The raw-ore samples are analyzed the same as the roasted ore, with the exception that the sample is carried to complete dryness with 5 gm. of potassium chlorate and 10 c.c. of nitric acid. If manganese is present it is precipitated by the addition of 1 gm. ammonium persulphate with the ammonia, or 10 to 25 c.c. bromine water. When copper is present a 1 per cent solution of sodium sulphide is used instead of the hyposulphite.

Specific Gravity Indicator in Use at Dome Mines, Ltd.

By C. W. Dowsett

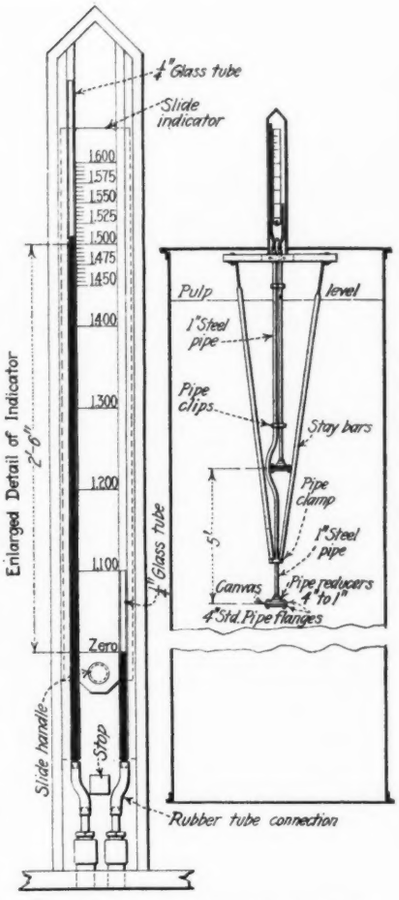
General Superintendent, Dome Mines, Ltd., South Porcupine, Ont.

An hydraulic balance specific gravity indicator in use at the Dome Mines mill consisted of a single tube with necessary attachments, but this arrangement proved to be somewhat unwieldy, inasmuch as it called for a correction of the depth of submergence before a reading could be taken, and this necessitated suspending the apparatus and counterweighting it. A new indicator was designed and installed. It embodies two tubes and is compensating with respect to variation in the pulp level. It occupies a fixed position in the Pachuca tank. In between the two flanges at the lower end of each tube, as shown in the accompanying figure, is a piece of cotton duck which acts as the filtering medium. The submergence of the longer tube can be, say, approximately 10 ft., more or less, while the shorter tube, which is firmly clamped to the longer one, has a submergence of exactly 5 ft. less. When the tubes are submerged in the slime pulp, the clear solution passing through the cotton duck rises up in the steel pipes and into the glass tube to establish the hydraulic balance between the column of slime pulp outside the tubes and the column of solution inside.

The difference in elevation between the solution levels in the glass tubes is the distance that the solution would rise above the pulp level in a tube that had a submergence of exactly 5 ft. A sliding scale is placed at the back of the glass tubes. When the difference in submergence of the pipes is 5 ft., each space of six inches on the scale represents 0.1 in the specific gravity, so that, if it is required to read up to 1.5, the scale must be calibrated in 6-in. spaces for 30 in. Each 6-in. space can be subdivided into tenths to represent 0.01 in. specific gravity.

To take a reading, all that is necessary is to place the lower mark on the scale (representing a specific gravity of one) opposite the solution level in the glass tube of the shorter pipe, when the figure denoting the specific gravity of the pulp is read on the scale at the solution level in the glass tube attached to the longer pipe.

A rise or fall in the level of the pulp in the Pachuca tank affects the solution level in both glass tubes exactly to the same extent, the only factor increasing or decreasing the measurement between the solution levels being the specific gravity of the pulp, as can readily be seen.



Specific gravity indicator for use in cyanide slime vats

Tempering Hand Steel

By Albert A. Leach

Ra-Tor Plac Co., Tyrone, N. M.

Great difficulty was experienced in tempering hand drill steel used at a prospect. Sharpening was done in a small portable forge, which was moved from place to place and set up without shelter as near to the work as possible. The drills produced by different men were all unsatisfactory, as it is difficult to judge the temperature in a bright light by the eye, and more particularly as the old-time expert miner, who was a craftsman at his trade, has become a *rara avis*. The steel was either too soft and would not stand up, or was too hard, and cracked and broke off at the bits. The following procedure immediately and entirely eliminated the trouble:

The drills were heated and sharpened and then allowed to cool. An ordinary magnet was then laid beside the forge (curved bar magnets from old Ford magnetos may be picked up in any garage, and were used in this case), and the steel was reheated. The drills as they warmed up were touched to the magnet from time to time, until they ceased to exhibit any attraction for it, when they were quickly thrust into the slack tub and quenched. Uniformly good results were obtained, even on a miscellaneous collection of steel, of different grades and make. [This principle is embodied in a tempering device that has been on the market for some time—Ed.]

the method over to some reputable institution (such as the assay department of some college) for a thorough trial, before broadcasting it? I am of the opinion that 90 per cent of the difficulties that beset the assay office of the present day are due not to faulty manipulation but simply to faulty methods.

Parral, Chih., Mexico. G. W. COTTON,
Assayer for San Francisco Mines.

Melting Point of Sulphides

THE EDITOR:

Sir—May we be permitted to call your attention to certain errors in the paper by Horace Freeman, contained in your issue of Dec. 19, 1925, the article being entitled "The Genesis of Sulphide Ores." Mr. Freeman refers to the melting points of certain sulphides as follows:

"Ferrous sulphide, 1,000 Degrees C." The melting point of this sulphide in the pure state is not far from 1,171 deg. C. In our own laboratory and using a sulphide containing 99.37 per cent FeS we found the melting point to be 1,163 deg. A student has since checked this result.

Cuprous sulphide is given as having a melting point of 1,100 deg. C. The pure sulphide has a melting point that is not far from 1,135 deg. C. We have obtained 1,128 deg. C., using a sulphide containing about 99.88 per cent Cu_2S.

It is quite possible that these differences may not have any importance in the subject on which Mr. Freeman writes. We find it impossible, however, to agree with him regarding the melting points noted.

Golden, Colo. CLARK B. CARPENTER.

Powder Boxes and Specimens

THE EDITOR:

Sir—Powder boxes are convenient, stout, and usually readily available at practically all Western mining camps. For this reason and for the further reason that when loaded with samples of specimens of ore or rock they make a package of convenient weight, they are frequently used by mining engineers and geologists for packing and transporting specimens and samples of ore and country rock. This is all very well if transportation is to be by mule back, wagon or auto, but "let the shipper beware"—the Interstate Commerce Commission has ruled that such containers cannot be accepted for transportation by freight or express. Embarrassing experiences by members of the Idaho Bureau of Mines and Geology staff during the past summer brought this matter quite forcibly to our attention, and I hope this note may serve to save some "grief" to other members of the profession. FRANCIS A. THOMSON.

Moscow, Idaho.

Who Buys Barite?

THE EDITOR:

Sir—We noticed an article in the Dec. 5 issue entitled "Who Buys Barite?" and wish to call your attention to the fact that our works, located at Collinsville, Ill., just across the river from St. Louis, is one of the largest purchasers of barite and zinc-bearing materials in the United States. We wish to be included in any such lists as you may make out in the future.

ST. LOUIS LITHOPONE CO.,
St. Louis, Mo. Major W. H. Landers.

Consultation

"Potential" and "Possible" Mineral Wealth

"I am interested in the proper use of the word 'potential' in dealing with mineral wealth. My understanding is that a mineral deposit represents 'potential' wealth, but that it is incorrect positively to announce 'potential' wealth in a district in which no deposits have been found. Is this correct? A prominent mining engineer recently referred to the 'potential mineral wealth' in an 'unexplored district.' Should intensive exploration fail to discover mineral deposits, and this condition has happened, the statement would be wrong.

"The dictionary defines 'potential' as synonymous with 'possible.' Does this mean that they are always synonymous? I have been accustomed to speak of 'possible" wealth in an unexplored area, but cannot bring myself to use 'potential' until something has been proven up. When it is proven up both 'potential' and 'possible' could be used in regard to the same mineral wealth, though the former would be preferable and might even be dropped altogether."

The usual understanding of the correct use of the word "potential" is in agreement with the conclusion expressed in the query. The primary significance of the word is precisely that of its root—Latin "potentia," power; that is, potent, powerful, mighty. When Shakespeare wrote, "O most potential love!" he used the word "potential" in its purely literary sense, of course. The second definition given in most dictionaries—"possible" as opposed to "actual"—affords a clew to the reason for the selection of the word by engineers to convey an impression of possibility of existence. A watershed possesses potentialities of power development, but unless and until a survey has justified the conclusion, it may not properly be said to be a potential (or possible) source of mineral wealth.

The English language is a very living thing. Dictionaries never catch up with it. Therefore one should be careful to avoid didactic pronouncements on the use of words, which may and do acquire meanings or shades of meanings for which there is neither etymological justification nor historic sanction.

Mining engineers are supposed by the general public to be professional men, and, in making reports or writing papers or articles, they should avoid the careless choice of words. It is better not to say that an area may contain potential or possible tonnages of ore, but, rather, that a geological survey may disclose the existence of ore deposits of such grade and size as to warrant commercial development.

Buyers of Antimony

"A request comes to us from Mexico asking for information regarding purchasers of metallic antimony and antimony ores and for the name of some importers of these products. We shall appreciate any assistance you can give us in answering this inquiry."

The addresses given below are those of firms in New York that might be interested in the products mentioned.

Ores

American Smelting & Refining Co., 120 Broadway
United States Smelting, Refining & Mining Co., 120 Broadway.

Metals

Wah Chang Corporation, 233 Broadway
Francis A. Cundill & Co., 63 Wall St.
Michigan Alkali Co., 21 E. 40th St.
C. W. Leavitt & Co., 30 Church St.
Federated Metals Corporation, 233 Broadway

came up. In this event we must suppose that the ores were deposited by some other method than the reaction of the sodium sulphide solution with water.

I seem to be unable to get away from the idea that there was water present all the time—so will say no more. JOHN B. PLATTS.

Masonia, Idaho.

Replacement or Displacement by Dikes

THE EDITOR:

Sir—In the 57th Annual Review and Year Book of the *Mining Journal-Press*, an article by J. Volney Lewis, on "Progress in Mining Geology," bears the further significant title: "Care in Field Investigations." Then under the heading "Injection and Crystallization" he states: "Billings has shown that the Medford dike, in eastern Massachusetts, was intruded without offsetting the older cross-dikes. Hence the walls were not pushed aside. The author concludes that the displaced rock sank in the rising basaltic magma. . . ."

This is interesting in view of the fact that the term "has shown" should be qualified by a large capital "IF" —if "care (has been used) in field investigations." In this particular case, and just how much of the geologic literature falls under this capital "IF" is unknown, the field work was not done with the care that the conclusions required. Later mapping of the district by myself by instrumental survey disclosed the fact that all the older cross-dikes referred to are offset, and the problem resolved itself into a geometric solution of a fault dislocation in which the results were as consistent as could be expected where such solution deals with assumed plane surfaces, whereas the actual surfaces are not actually plane.

The correction of Mr. Billings' paper will be published eventually by either Mr. Billings or myself.

The important thing, however, is not the Medford dike, but the capital "IF" that should always stand beside the all too commonly used statement that "so-and-so has shown."

Does the Medford dike referred to still have the bearing assigned to it by Mr. Lewis on the mechanics of the intrusion of "veindikes"? WILLIAM F. JONES.

Cambridge, Mass.

The Why of Flotation

THE EDITOR:

Sir—I should like to ask a few and suggest a few questions. "Why is flotation?" I asked a colleague of mine recently and I repeat, "Why?" For three years I have been pursuing that question while working in the research department of a large mining company and have got no nearer solution than the first day when I determined which was concentrate and which tailing. I am sure it is not for lack of scientific preparation in physical and organic chemistry, thermodynamics, and so on, or colloid behavior. I have mastered their language sufficiently to get credit from a university of no mean reputation, yet I know less every day. I have outlined and written a chapter or two of a paper that I had hoped to prepare on "some problems of flotation control" for my university, but there has never a week gone by that did not bring forth some new angle to "the problem."

We have theories "till the cows come home." Every "long-haired prof" that ever saw bubbles in his wash-bowl has some explanation, yet they all seem to fall down in an instance or two.

Do you think a questionnaire sent out to flotation men in the field and to such laboratories as Du Pont, the U. S. Bureau of Mines, and so on, asking certain definite questions, and the answers compiled, would throw some new light on the "art" and benefit the industry? I use the term "art" since "Cy" Perkins (great patentee of flotation), Mellon Institute Fellow, told me in conversation one day, "Flotation is one of those industries in which the art has far outstripped the science." "Art" is right.

I have hesitated to write to you for reason of restraint which I unconsciously feel might be put upon my expression of ideas by my employers. I have no secrets that I know as such, but the ignorant and short-sighted executive might take offense at apparent (to his ignorance) open disclosure of secrets that have probably been known to scientific men since the beginning, but which are Greek to the lay.

Some interesting angles are constantly bobbing up in my work that I should like to be able to air and discuss with men and engineers who know the language. You have no idea the *scientific* lonesomeness one suffers away from contact with his profession. To overcome such a nostalgia, might we not be able to get up a round-table discussion page somewhere for the purpose of dropping in with a few ideas and questions now and then occurring and give them a good "panning," or would someone get overheated and lose sight of the theory for argument?

I should like to know what the relation is of the amount of lime to slime—primary "God-made slime" used in mills where an alkaline circuit is used. I have evolved a quantitative method for determining the proportion of absorbing slimes in an ore, and should like to hear from others similarly employed. I have found base-absorbing ores, ores that leave an acid reaction when put in contact with a neutral salt; peculiar oxidation-reduction processes arrested in our minerals and a host of interesting observations for the pursuit of an explanation of which the copper industry will never pay. But among the many seekers after truth some good might come from exchanging ideas. Rather give the other fellow a "live tip" now and then, than probably painfully follow through something he has already done and solved to a similar solution. This is futile.

Phoenix, Ariz. JAMES BROWN.

Lead, Iron, and Cadmium in Zinc

THE EDITOR:

Sir—I note in your issue of Dec. 26, 1925, a method for the determination of lead, iron and cadmium in slab zinc. I fear this method, if followed out to the letter, would lead one into difficulties. To begin with, 10 grams is too small a sample of zinc of the purity made nowadays, and 15 cc. of a saturated solution of ammonium acetate is most certainly excessive to dissolve the lead that exists in a 10-gram sample. Most standard textbooks agree, and I have found from years of experience, that aluminum sheet does not completely precipitate cadmium under any conditions.

Would it not be better to leave the dissemination of chemical methods strictly to standard textbooks, unless, perchance, someone discovers a short-cut to the same result or an obvious advantage over the standard method? In such case, would it not be wise to turn

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

CONSOLIDATED Mining & Smelting Co. has prosperous year; treated 391,606 tons of ore; plans construction of another 1,000-ton concentration unit; new tailing mill ready soon.

Calumet & Arizona Mining Co. to reorganize—Iron Cap Copper wins in Supreme Court—Nitrate deposits reported near Winkelman, Ariz.

Stockholders approve merger of Underwriter's Land and Consolidated Lead & Zinc companies; directors named.

Bureau of Mines plans to extend co-operative research work with Great Britain to include metallurgical problems—Six-cent tariff asked for copper.

John C. Greenway, late general manager of Calumet & Arizona Mining Co. and New Cornelia Copper Co., buried at Ajo, Ariz.

Iron-mining companies join Michigan College of Mines in research work to devise ways and means to utilize low-grade ores—Minnesota iron mines preparing for busy season.

Nipissing shipments exceed $500,000 in three months—Kirkland Lake opens oreshoot on 1850 level—Cobalt Contact constructs mill.

Tin stocks low in England; Nigerian deposits promising—Harriman & Co. produced 100,000 tons of Russian manganese ore in 1925.

Helium Reserve No. 1, in Utah, enlarged by 5,155 acres; loss of precious gas impending in Texas due to uncertainty of Federal appropriations.

Park-Utah aërial tramway completed; has 1,000 tons' daily capacity.

Copper Queen Changes from Blast Furnaces to Reverberatories

Improvements to be made in the Copper Queen smelting works at Douglas, Ariz., have been delayed on account of changes in plans, but the work will proceed with dispatch from now on. Primarily the changes were for the purpose of changing to all reverberatory smelting and shutting down the blast furnaces now in operation. Originally it was planned to equip the present reverberatory furnaces with new charging and slag-disposal facilities and new boiler settings. Also, additional roasters were to be installed and Cottrell treaters were to be provided for the gases from the old and new roasters.

General drawings have now been made and the work will proceed on the new plan. In the main the plan calls for two roaster-reverberatory smelting units, each unit consisting of six 19-ft. outside diameter eleven-hearth roasters superimposed over a reverberatory furnace 22 ft. wide by 93 ft. long inside. The roasters will closely follow a design worked out by Messrs. Stout and Robinson. The calcine may be discharged into the reverberatory furnace in the center or along its side walls as desired. Tube-type Cottrell treaters for catching the dust will be located directly over the roasters. Each reverberatory furnace will have four 500-hp. waste-heat boilers, thus effecting an enormous saving in coal used for power purposes.

A new 22-ft. diameter 350-ft. stack will be built and facilities for delivering the ore from the present beds to the roasters will be provided.

Cash Bonuses Given First-Aid Men by Globe Mines

DILIGENCE and studious application to first-aid training is finding its reward in the distribution of bonus money in the Globe-Miami district, Arizona, to members of prize-winning teams of four of the big corporations engaged in operations there. In each case $25 was paid outright to members of each of the winning teams, and further payments of $15 monthly are to be added to the pay checks of the first-aid men.

Four teams from the Inspiration Consolidated Copper Co., and one team each from the Miami Copper, Old Dominion, and International Smelting companies competed for the cash prizes.

New Ore Discovery Reported from United Verde Extension

Exaggerated reports have been published regarding a new strike of high-grade ore at the United Verde Extension, near Jerome, Ariz. The new orebody occurs about 500 ft. southwest of the Edith shaft, and such exploration as has been made indicates that it is of major importance, being principally chalcocite with a considerable admixture of cuprite. Direct information from the mine is to the effect that the new orebody has not been opened to an extent that will justify any statement as to its size, the drift having been run only a short distance. It is understood, however, that the orebody is "new" in every sense of the term.

Joplin Producers Fear Excess Output of Zinc May Curtail Operation

Zinc ore producers of the Joplin-Miami district are worrying over the specter of overproduction. During the week ending Jan. 23, 178 mills were reported in operation. This is a new district record. Thirty-seven of the 178 were operating overtime or night shifts. Operators believe unless the tendency toward overtime operation is curbed, ore output will soon become so heavy as to bring about an uncomfortable surplus. However, with the 178 mills running, production for the week was reported at only 17,607 tons, a slight reduction over previous weeks.

Among the new properties recently coming into production are the American Prospecting & Development Co., the Barbo Mining Co., the Vantage Mining Co.'s No. 4, and the new mine of the Federal Mining & Smelting Co. at Granby, Mo. The Eagle-Picher Lead Co. is making a good production from its new mine at Peirce City, Mo., where it is producing a high-grade zinc concentrate which it is using in its own smelter at Hillsboro, Ill. The American Zinc, Lead & Smelting Co. has obtained an operating option on the S. S. & G. and Roanoke leases in the South Picher camp. It is the plan of the company to put drills on the property as soon as the lease has been finally approved, and to place the mill in operation immediately thereafter.

The Golden Rod Mining & Smelting Co. recently started the Miami Wonder mill in operation. It obtained a lease on the property some months ago and has been drilling it. The mill will be known as Golden Rod No. 23.

Calumet & Arizona Mining Co. to Be Reorganized Under Delaware Laws

The Calumet & Arizona Mining Co. will surrender its Arizona charter when it expires, on March 1, 1926, and will be reorganized under the laws of Delaware. This will necessitate an exchange of stock certificates, which must be forwarded to the Bankers Trust Co., 16 Wall St., New York, the company's transfer agent. These will be exchanged on a share-for-share basis, the company retaining the same name and with the same capital and par value of stock—namely, $6,500,000, divided into 650,000 shares of a par value of $10 each. Application is being made to list the Delaware stock on the New York Stock Exchange.

Mining Activity in Western Alaska

The New York-Alaska Gold Dredging Co. is sending in 500 tons of dredging machinery to Tuluksak Creek, 40 miles from the landing on Kuskokwim River, Alaska. A tractor is being employed in transportation.

J. Royden has taken an option on seventy-five bench claims on Hammond Creek, near Koyukuk, where he plans to install a hydraulic plant, taking water through a 30-mile pipe line from the north fork of Hammond Creek. He is putting two boats on the Tanana for transportation.

Information from Nome is to the effect that there has been an active renewal of prospecting in that country. The Hammond Consolidated Goldfields Co., now operated by the United States Smelting, Refining & Mining Co., handled 1,562,927 cu.yd. of gravel last year. The yield has not been made public, although the company claims to have made a profit. Plans for next season provide for a large increase in the yardage to be handled.

Iron Cap Company Wins in Superior Court

In refusing to grant a writ of certiorari sought by the Arizona Commercial Mining Co. to review a decision of the Arizona Supreme Court in favor of the Iron Cap Copper Co., the United States Supreme Court on Jan. 25, 1926, in effect affirmed the decision of the Arizona court, which held that the title of the Iron Cap company to valuable veins of ore was valid. The dispute between the two companies involved the Defiance and other claims in Gila County, Ariz., which have been in litigation since 1919.

Gold Discovered in Granite Near Manhattan, Nev.

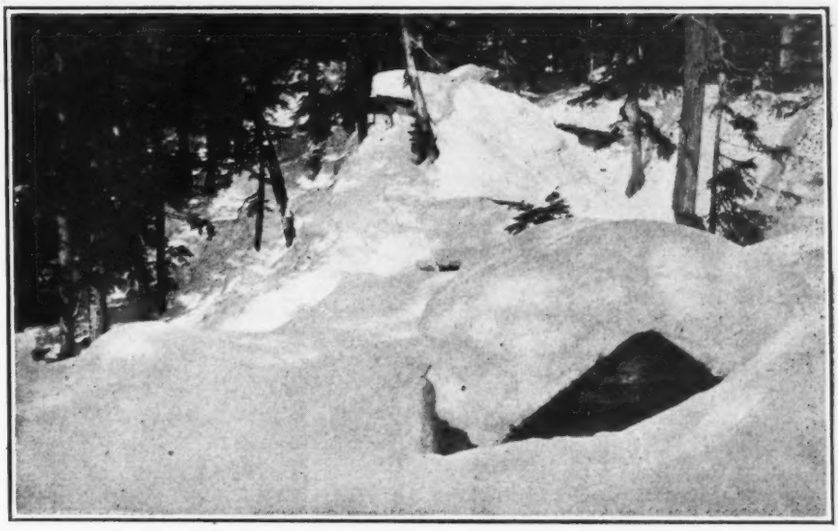
A new and promising gold discovery has been made in the granite which bounds the Manhattan (Nev.) sedimentaries on the south, not far from the contact, in the southwest part of the district. This find was made by leasers on the Sloan and Blaker property about 300 ft. southwesterly from some old shallow surface workings from which a small tonnage of gold ore was extracted several years ago.

Fern Gold Mining Co. Purchases Talkeetna Mines

There is great activity in the gold-quartz mines on Willow Creek, Alaska. An option has been taken by eastern Canadian operators on the Lucky Shot, War Baby, and Gold Bullion. The Fern Gold Mining Co. of Spokane has increased its holdings by the purchase of the property of the Talkeetna Mines Co., Alaska. This adds twenty-two claims to the holdings of the Fern company, besides water rights, a mill, and a tramway. The Fern mill is to be enlarged to a capacity of 100 tons a day at a cost of $100,000. The Talkeetna contains the extension of the main Fern vein in dip and strike and the acquisition of the property is thus a valuable addition to the Fern holdings. Production of the Fern Co. has been averaging 600 oz. gold per month.

Magma Copper Co. Soon to Have Extensive Improvements Under Way

The Magma Copper Co. has decided on a program of improvements for its mine near Superior, Ariz., which will include the sinking of a 2,500-ft. shaft and the construction of an electrically operated surface tramway for transporting ore from the mine to the mill. The new shaft will be west of the present workings and northwest of the company's general offices. It will have four or five compartments and the equipment will be modern in every respect. It is to be sunk primarily for ventilation, but will be equipped for hoisting rock, and its use will lessen the cost of the exploration work to the west of the present workings. The cost has been estimated at $250,000. Sinking will be under way within thirty days.



Miner's cabin under 11 ft. of snow, Hyder, Alaska

Merger of Underwriter's Land and Consolidated Lead Companies Approved

At a meeting held on Jan. 28, stockholders of the Underwriter's Land Co. and of the Consolidated Lead & Zinc Co. formally ratified the consolidation of the two, which was voted by the directors of the companies in December. The new company, which will be known as the Consolidated Lead & Zinc Co., has mining properties valued at $3,000,000, and will be one of the three largest producers of the Joplin-Miami district. It will incorporate under the laws of Delaware, and a new issue of stock will have no par value. Stockholders will receive two shares of this new stock for each share of stock they now own in the present companies.

Directors of the new company are John B. Swift, president of the Eagle-Picher Lead Co., Cincinnati; A. E. Bendelari, vice-president and treasurer of the same concern, of Chicago; George W. Potter, vice-president of the Eagle-Picher Co., of Joplin; T. C. Curry, of Picher, Okla.; John A. Schaeffer, vice-president of the Eagle-Picher Co., of St. Louis; Fred N. Bendelari, president of the Underwriter's Land Co., of Joplin; and Thomas A. Dysarf, of St. Louis.

The surface tramway will be constructed from the mouth of the tunnel which connects with the main working shaft at the 500 level. Grading for the tramway has already been started. Shaft No. 3 is at present being sunk to the 2,500 level, which will be reached early in February. The total cost of the program of improvements is expected to reach $500,000.

United Western Sinks Shaft Deeper at Oatman

Jack Harrington, of Globe, Ariz., has taken a contract to sink the shaft of the United Western mine, at Oatman, Ariz., from the 500 level to the 700, and to drive 200 ft. of drifts at that level. Mr. Harrington has handled some of the most important shaft-sinking contracts in the state, his two largest jobs being at the Inspiration and Miami properties. His latest undertaking was the sinking of the Kay Copper shaft to the 1,400 level and the driving of 1,200 ft. of drifts and crosscuts.

Mr. Harrington takes a picked crew with him from contract to contract, bases his scale of wages on a bonus system, operates his own drilling machinery, carries his own insurance, and assumes entire supervision of the work.

New Park-Utah Aërial Tramway Capacity 1,000 Tons Daily

Handles Ore, Concentrate, Coal, and Mine Supplies—Gravity Supplemented by Electric Power

By Gail Martin
Salt Lake City, Utah

UNINTERRUPTED transportation facilities for the Empire Canyon properties of the Park-Utah Consolidated Mines Co., operating at Park City, Utah, are assured by the installation of a 4,700 ft. electrically driven aërial tramway. Not only can the hauling of ore and supplies be continued without stop because of bad weather conditions or bad roads, but cost of transportation has been reduced to a fraction of what it was by teams.

Complete success has attended the use of the tramway since it was started on Jan. 10, 1926. The first day it hauled 310 tons of ore.

The new tramway is as modern in every detail as money and engineering talent can make it. Several unusual and difficult problems have been solved entirely to the satisfaction of the management by the company's chief engineer, Oscar Friendly. Various grades of product—ore, and zinc and lead concentrates—are handled wholly by automatic systems. All of the ingoing supplies—lumber, coal, timbers, and miscellaneous freight—can be hauled without interfering at all with the carrying of ore.

The new tramway is of the Trenton type, with two speeds—500 and 250 ft. a minute, respectively. The towers are all of heavy steel set on concrete base. Maximum height of the towers is 55 ft.; minimum, 16 ft. Five towers and one 2-bent support and two 3-bent supports have been erected.

The difference in elevation between the upper and the lower terminals is 317 ft. For the down track, 1⅛ in. lock coil steel cable has been used; on the return, ⅞ in. cable. The traction cable is ¾ in. Buckets are ten cu.ft. capacity, with a friction grip.

The lower terminal at the portal of the Ontario No. 1 drainage tunnel is a structure 90 ft. long, 30 ft. wide and 60 ft. high comprising four stories. The upper story is the discharge station; the second and third stories are storerooms; and the first comprises the timber-framing department.

From the timber yard surrounding the terminal station, timber is conveyed by the monorail system into the first floor to be framed. From the saws, the timber is loaded on timber trucks for distribution through the Ontario mine or loaded on cable carriers for transportation to the Judge, Daly, and Daly-West properties in Empire Canyon.

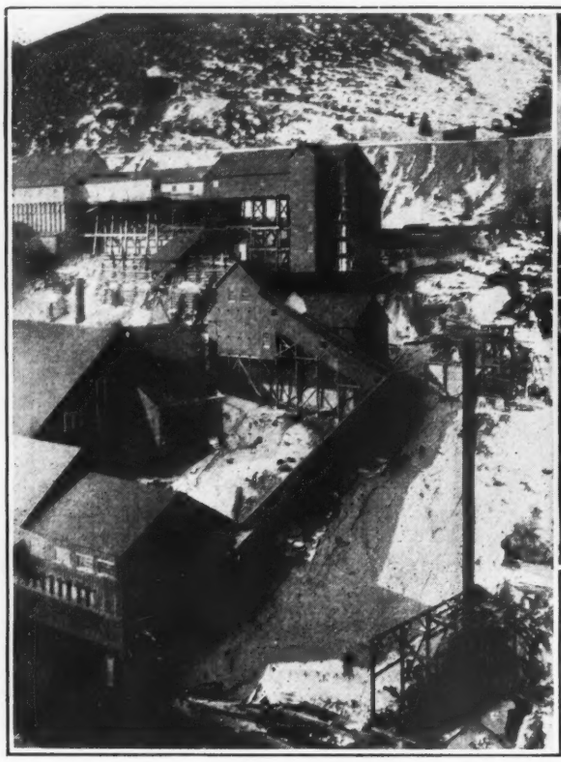
The carriers are raised by elevator to the tramway floor and switched on the main tram line without interfering in the least with the movement of ore. On reaching the upper terminal, the load is dropped on to a timber truck and elevated directly to the main motor-haulage level for distribution. Supplies and other materials are hauled in the same manner.

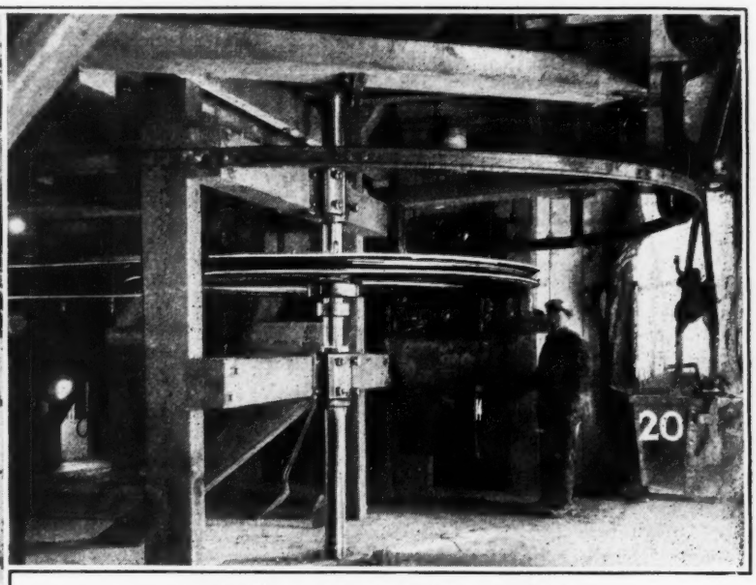
Coal for the various properties is dropped from railroad cars at the lower terminal and elevated by bucket conveyor to the main tramway floor and sent to the Judge mine in returning ore buckets. Loaded coal buckets are automatically tripped a short distance from the upper terminal and the coal dropped through a pipe to the boiler-room bins. From here a conveyor carries the coal to an automatic pulverized-fuel stoker. From the time the coal is unloaded at the Ontario station until it is consumed it is not touched by hand. Coal for use at the various properties is elevated to the main haulageway level and distributed underground in the same manner as timber and other supplies.

Successful handling of diverse mine products involved several difficult problems. In the first place, ore and two grades of concentrates must be kept separate. Concentrate must be elevated from the mill to the tramway loading station. Notwithstanding that some premonition was felt, belt conveyors have been entirely successful in elevating the moist product to the loading terminal. No difficulty has been experienced with concentrate adhering to the belt which elevates the mill product to the measuring pockets for loading. In six hours, the entire daily production of the mill, amounting to 250 tons, can be handled.

Ore is carried from the upper-mine bins by belt conveyors directly to the measuring pockets for loading on tram buckets. At the lower terminal, the ore is dropped directly from the tram bucket into railroad cars. Chute capacity sufficient to hold a forty-five minute run of the tramway, while cars are changed, has been provided.

Electricity supplies power for all purposes. On the full return load, 7½ hp. is used; for lowering, 2½ hp. Capacity of the tramway is 1,000 tons daily. A slight additional expenditure will increase this. At the lower terminal at the head of Main St., Park City, switching and storage facilities for large-scale operation have been provided.





Loading pocket at upper terminal

Left: Loading terminal of the new Park-Utah Consolidated Mines Company tramway in Empire Canyon, Park City, Utah

At the lower left is the Judge concentrator. Sheds covering conveyor belts for transportation of concentrate to loading terminal lead from mill up to loading station. Buildings at top of picture are ore bins and sheds in which trains from the Judge tunnel are run.

Boulder County Commissioners Encourage Prospecting

Boulder County, Colo., which originated the idea of community grubstaking of prospectors as an aid to the mining prosperity of the region, has been successful in securing financial support from the board of county commissioners, which appropriates a small sum annually from the general county fund to be used in payment of assay fees where claim owners are without adequate funds. This money is administered through the Boulder County Metal Mining Association. In 1925, $300 was set aside from county moneys for this purpose. At the prevailing fees in the region, this paid for 300 assays. The mining association has asked the commissioners to increase the amount to $500 for 1926 and is hopeful that the request will be granted.

Experience has shown that many miners who develop claims in a small way lack funds for assays and accordingly ship several tons of ore with no knowledge of its value other than its appearance to the eye. The assay fund is available to such men and enables them to prosecute their work on a more intelligent basis.

It is the custom of the county to appropriate funds annually to the county fair, chautauqua, and other activities of a public nature. In presenting their case, the mining interests held that a revival of mining would mean much more to the county at large than the organizations named.

Greenback Mining Co. Discovers Gold Ore

The Greenback Mining Co., operating about 45 miles south of Casa Grande, Ariz., is prosecuting development work on a deposite consisting of a series of prominent quartz veins varying in width from 10 to 25 ft. Two shafts are being sunk. These are three-quarters of a mile apart, the Tyler shaft being about 330 ft. deep, and the Greenback shaft only about 130 ft. The Tyler shaft is said to be in ore averaging $20 to $40 in gold a ton; that from the Greenback shaft is reported to average somewhat higher. Both shafts appear to be in the center of two separate oreshoots in the vein. A substantial camp has already been established; a six-drill air compressor is in operation, and a modern hoist has been installed. Tom Marshall, formerly mine foreman at the Lowell division of the Copper Queen, in Bisbee, is in charge of the work as superintendent, and Frank Royer, of Los Angeles, is consulting engineer.

Deposits of Nitrates Reported Near Winkelman, Ariz.

Nitrate deposits, which are said to cover an area of eight square miles, in the Aravaipa River box canyon, near Winkelman, Ariz., have been discovered by William Carter and his son Wilbur Carter, owners, of Glenbar, Ariz. Reports from unofficial sources state that the deposits comprise practically an entire mountain on the west side of the Aravaipa River, 28 miles southeast of the mining town of Winkelman. According to reports, a New York firm now holds a bond and lease from Carter, subject to governmental restrictions covering the mining and selling of nitrate found in this country. Work is said to have already been started on a road leading from the nitrate beds to the Winkelman-Mammoth highway.

Reorganization Planned for Round Mountain Mining Co.

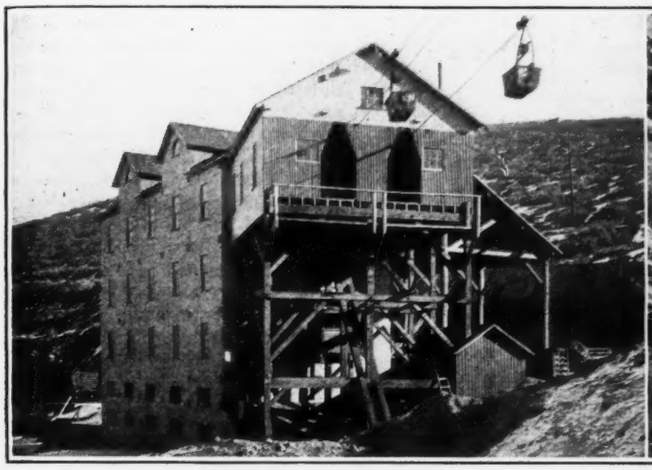
Stockholders in the Round Mountain Mining Co., which operates lode and placer mines at Round Mountain, Nevada, have been notified that at the annual meeting, to be held in Tonopah on Feb. 15, a plan for reorganization on an assessable basis is to be submitted. Operations have not been profitable for several years. The plan is to organize a new assessable company, the Round Mountain Mines Co., which will take over the assets of the present Round Mountain Mining Co., including 2,490 acres of placer ground, with placer rights on 216 acres additional; water rights, pipe lines, and other equipment; and a valuable lode property adjoining the placer ground. The lode mine and mill are said to be in good condition, with the mill treating 75 tons of ore per day at present.

Consolidated Mining & Smelting Co. Has Prosperous Year

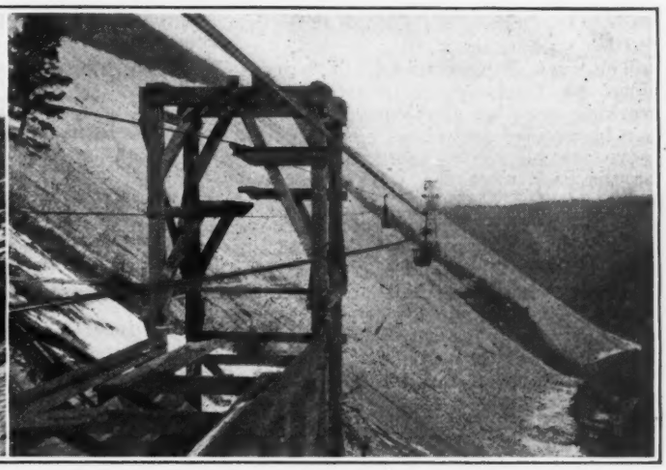
The year 1925 was the most prosperous one in the history of the Consolidated Mining & Smelting Co. of Canada. The company received at its smelter 391,606 tons of ores and concentrates, 343,745 tons of which came from its own mines; the remainder came from the mines of 105 independent operators, of which 50 were in the Slocan-Ainsworth-Lardeau district and 23 in the Boundary district, of British Columbia. The twelve largest independent shippers were: Silversmith, 7,447 tons; Bluebell, 7,112; Allenby Copper Corporation, 5,953; Knob Hill, 4,695; Quilp, 3,993; McAllister, 987; Paradise, 951; Emerald, 926; Providence, 847; Ruth-Hope, 790; Duthie Mines, 735; and Sally, 711 tons. Estimated metal production was: 21,352 oz. of gold, 4,397,455 oz. of silver, 1,800,000 lb. of copper; 235,008,000 lb. of lead, and 97,222 lb. of zinc. This production does not include the production of the ores from the two State of Washington mines, Knob Hill and Quilp, nor from the Allenby Copper Corporation's concentrate. The value of the production is placed at $29,973,453, which compares with $16,882,129 in 1924 and $6,838,420 in 1920 and brings the value of the company's total production to date to $198,447,269.

Added to the customary dividend of 6 per cent, the company has declared a 20 per cent bonus, which brings the 1925 disbursement up to $3,205,570.

The company has started on the construction of another 1,000-ton unit to its Sullivan mill, which will bring the rated capacity up to 4,000 tons per day, and the actual capacity, judging by the existing mill, will slightly exceed that amount. It is expected that this addition will be in operation by midsummer. The new 500-ton mill to treat the old waste and tailing dumps at the St. Eugene mine, at Moyie, will be in operation early in the spring, and it is understood that the company intends to equip the Old Sport mine and the Sunloch mine, on Vancouver Island, with mills and bring them to the producing stage during the year. This will assure an ample supply of concentrate for the copper department.



Discharge terminal at the mouth of the Ontario No. 1 drainage tunnel



View from upper terminal of Park-Utah tramway across Alliance dump

Washington News

By Paul Wooton
Special Correspondent

Bureau of Mines to Extend Co-operative Research With Great Britain

Co-operative research on coal-mine explosions by the governments of Great Britain and of the United States has been so successful that plans are being made for its extension to the field of metallurgy. The coal work also may be enlarged so as to include research on fuels. Dorsey A. Lyon, the assistant director of the U. S. Bureau of Mines, in charge of its research branch, and George S. Rice, the Bureau's chief mining engineer, will go to London in the spring to discuss the matter with the British authorities.

The work, if undertaken, will be confined to fundamental research. By working together duplication of effort can be avoided and plans made so that more can be accomplished than would be the case were the work conducted independently.

In addition to the exchange of information as to the progress of work on mine-explosion problems, Dr. H. F. Coward, a British specialist, is working at the Pittsburgh station of the Bureau of Mines with the group engaged in this study. In the same way Dr. Reinhardt Thiessen, of the Bureau of Mines staff, is working in the British laboratory at Eskmeals.

Six Cent Tariff Asked for Copper

The copper-tariff bill recently introduced in the Senate by Senator Ralph H. Cameron, of Arizona, providing for a duty of 6c. per lb. on all foreign-produced copper entering the United States, is similar to the measure introduced in the House by Representative W. Frank James, of Michigan. It would amend the tariff act of 1922 by placing a tax on copper in any form, whether in ores, concentrate, or alloys, provided it is actually recovered, or as metal old or new.

The Cameron bill has been referred to the Committee on Finance, and it is expected it will receive attention at this session of Congress. Producers in the Michigan district are strongly in favor of copper-tariff legislation, believing it will equalize cost of production and result in a more substantial market for American mines. The proposed tariff has been endorsed by Calumet & Hecla, Copper Range, and Quincy mining companies.

Texas Helium Loss Impending

That Congress has jumped to the conclusion that lighter-than-air craft is impracticable is an impression widely held in Army and Navy circles. The attitude of members at recent hearings, even when aviation would be mentioned only incidentally, indicates that the prevailing disposition is to abandon further efforts to navigate the air in such craft.

This is contrary to the prevailing feeling of Army and Navy officials. The whole desire is to keep on trying, but the various appropriation committees seem disinclined to vote more funds for "dangerous folly." To stop now and admit defeat is particularly galling to those branches of the services which have been studying and wrestling for years with the problems of lighter-than-air craft. The feeling among those engaged in that work is that all possible lessons should be learned from the disasters which have befallen this type of ship, but that it would be contrary to the spirit of America to quit when there are many reasons to believe that the problem can be solved.

It is also feared that Congress feels so discouraged about the prospects that it is likely to curtail the helium programs. Unless production can be continued in Texas, where helium is being stripped from the gas as it passes into consumption, an irreparable loss will be suffered, it is contended.

Helium Reserve No. 1, in Utah, Enlarged

Addition of a large area of public land to the Navy's helium reserve in Utah was authorized in an executive order issued Jan. 29 on recommendation of the Interior Department. The area totals 5,155 acres directly adjoining the reserve in Emery County. The purpose of incorporating it in the reserve is to preclude the possibility of drainage from wells that might eventually be drilled outside the reserve's boundaries.

A recent survey of the structures in the vicinity by the U. S. Geological Survey differed materially from data previously collected and indicated the danger of drainage. Lands included in the area are withdrawn, subject to valid existing rights from all forms of settlement, location, sale, or entry by the executive order.

Colorado-Gilpin Gold Mines Sold

J. S. Lewis and W. R. Wright, of Denver, have formed a company under the name of the Big Five Mining Corporation and have taken over the Colorado-Gilpin Gold Mining Co., operating in the Black Hawk district of Gilpin County. During the war this mine produced radium, but since then it has been idle. The property consists of about 100 acres and a forty-ton mill. The mine is opened by a 450 ft. tunnel and crosscuts. Five distinct ore veins have been encountered, bearing gold, silver, lead, and zinc.

Record Drilling Speed

AT THE Dome property, in South Porcupine, Canada, an interesting record has been made in fast drilling. On Jan. 19, on one of the regular shifts, an average drilling speed of 21 in. per minute was secured. The air pressure was 80.2 lb., and the air consumed per minute at 80 lb. pressure was 190.5 cu.ft.

Andrew Bros. Mining Co. Lose Mill by Fire

The concentrating plant of the Andrew Bros. Mining Co., at Crestline, Kan., in the Joplin-Miami field, was destroyed by fire of unknown origin on the morning of Jan. 6. The plant was comparatively small, being of about 150 tons' capacity, and cost about $50,000. The property was partially insured. It has been in operation about three years. The compressor and several oil engines were lost with the building.

Minnesota Iron Mines Preparing for Busy Season

Several mines are busy on winter stripping on the Mesabi Range this winter. In addition to the Model 350 shovel working on the North Forty overburden near Hibbing, a smaller shovel is busy on the extreme west end of the Mahoning pit clearing the reserve 40 of ore located there. With these two 40's cleaned off, this pit, which embraces the Hull Rust, Mahoning, Pool, Day, Burt, and Sellers mines, will be two and one-half miles long. At the Fraser mine, at Chisholm, one shovel is busy stripping. At the Minneawas mine, just south of Virginia, a Model 300 shovel is working double shift removing overburden, and at Coleraine the Oliver Iron Mining Co. has one big shovel cutting the approach into its new Morrison pit.

John C. Greenway Laid to Rest at Ajo, Ariz.

On the crest of a little knoll, a few hundred yards from his home, from which he used to wave his wife goodbye when commencing his regular morning ride, and in the presence of over 3,000 sorrowing friends, General John C. Greenway, soldier and engineer, was laid to rest early Tuesday morning, Jan. 26, 1926. Veterans of the World War led the procession, followed by veterans of the Spanish-American War. Approximately one hundred Rough Riders followed. The casket was carried by picked men, selected from all walks of life, its massive weight thus being transported to the roadway below the Greenway residence. It was then carried in the same manner up the trail to the knoll, where the tomb had been dug from the solid rock and concreted and lined with copper.

Giant airplanes circled overhead during the funeral ceremony, dropping flowers. A volley was fired over the grave and "taps" sounded as a soldier's farewell. The first state flag of Arizona was brought to Ajo and flies at half mast over the grave.

The little town of Ajo was filled to overflowing with soldiers, mining men, engineers, prospectors, politicians, and business men. In fact, men in all walks of life came to pay their last respects to one of Arizona's outstanding figures. Literally tons of beautiful flowers were sent to Ajo for the ceremony, including one immense floral offering from the town of Ajo, in recognition of General Greenway's interest in civic affairs and city planning.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Kirkland Lake Gold Opens Oreshoot on 1,850 Level—Other Developments

At the Kirkland Lake Gold property in the Kirkland Lake district, Ontario, the oreshoot found some time ago on the 2,000 level has recently been cut at 1,850 ft., the orebody has been drifted on for 50 ft. and averages approximately $50 a ton. A new station has been cut at 2,100 ft., but the shaft will be continued to 2,250 ft. before any crosscutting is done. At the 2,000 level the oreshoot had a length of about 270 ft. and will not exceed this length on the 1,850 level. It is believed, however, that there is a rake to the west and that greater lengths of ore will be found at deeper levels.

At the Blue Quartz mine, in the Painkiller Lake section, a new mill having a capacity of fifty tons a day will soon be completed. The building of the mill is a result of developments encountered at the 500 level, where officials report that an oreshoot 325 ft. long carrying $18 over 42 in., has been opened up. It is expected that milling will start at the rate of thirty tons a day.

The Mining Corporation of Cobalt has decided to sink a 250 ft. shaft on the Cryderman gold property, in the central Manitoba district. The company staked a large number of claims last year, and the main vein has been trenched for a distance of 600 ft., and it has been indicated for an additional length of 900 ft., the average width being 12 ft. Another vein parallel to the main vein, from 4 to 6 ft. wide, shows free gold in several places and has been proven for a length of 150 ft. A steam plant equipment has been ordered and should reach the property some time in March.

Nipissing Shipments Exceed $500,000 in Three Months

The report of the Nipissing mine for the three months ended Dec. 31, 1925, shows that the company mined ore of an estimated net value of $382,283, and shipped bullion and residues from Nipissing and customs ores of an estimated net value of $570,000. This indicates a total production for the year of $1,463,000, a decrease of approximately 30 per cent from that of the previous year. Earnings, however, are sufficient to maintain the 3 per cent quarterly dividend, and the company also has a cash surplus of over $4,000,000.

Cobalt Contact Constructs Mill

Good progress is being made with the mill construction at the Cobalt Contact property. The concrete work has been completed and most of the frame work is on the ground. The mill will have an initial capacity of fifty tons a day, and official reports are to the effect that underground development is satisfactory. The company has acquired a number of properties in addition to the Contact, among them the old Green Meehan, which has produced more than 300,000 oz. of silver. The same interests which control the Contact also have the Foley gold mine, in northwestern Ontario. A winze was sunk from the 400 to the 600 level and will be continued to permit opening up of two new levels at 700 and 800 ft. On the 500 level the No. 3 vein is said to average 55 in. in width and carries commercial ore. Work on the 600 level is now nearing this oreshoot. A mill is also being constructed on this property.

At the Coniaurum property preparations are being made to continue the shaft from the 1,000 to the 1,500 level. On the 1,000 level a number of veins have been found, some of which carry ore of commercial grade, but it is believed that better and more consistent results will be obtained from greater depth. The property is controlled by the Coniagas Mines, of Cobalt.

Amulet to Continue Development

The directors of the Amulet property, in Quebec, have decided to carry on a much more extensive campaign of development and are ordering two complete mining plants, one of which will be placed on the No. 3 area and the other on the No. 4, where the most recent discoveries have been made. Another diamond drill will also be taken in to explore the No. 4 area at depth.

Mining Company Rewards Men for Continuous Service

AT THE CLOSE of a prosperous year all married men of one or more years' service with the Consolidated Mining & Smelting Co. of Canada were given a bonus of $50; those of six months' service, $25. Single men of similar service received half of these amounts. Furthermore, at Christmas the company distributed 1,500 turkeys among its married employees, and the single men received $3 in merchandise at the company's stores.

Engineer Gold Mines Handling 50 Tons per Day

The Engineer Gold Mines, operating at Atlin, B. C., recently made a shipment of bullion valued at $28,000. The company also made a shipment of concentrate to the Tacoma smelter. The mill is treating about fifty tons of ore per day.

Financing of Utica Mines Delayed

At a meeting of the preferred shareholders of Canadian Mines Merger, at Kaslo, recently, Colonel H. H. Armstead failed to get the necessary majority to enable him to carry out his scheme for financing the Utica mine. Colonel Armstead had a syndicate of Detroit capitalists who were prepared to provide $300,000 for the development and equipment of the property, if the existing preferred shareholders were prepared to forego their preferences.

Dome Mines, South Porcupine, Continues Diamond Drilling

Conditions underground at Dome Mines, in the Porcupine district, continue to be satisfactory, although no new developments are reported. Diamond drilling from the fourteenth level to explore the Keewatin underlying the sediments has not yet succeeded in finding anything, but it is believed that the greatest possibilities lie further to the east. One important orebody found last year on the fourteenth level has been developed for 300 ft. which shows a width 10 to 20 ft. carrying $8 to $10 a ton. This ore extends for only a short distance above the fourteenth level, and its size and importance cannot be determined until the main shaft is completed to the sixteenth level.

The company has staked a number of claims in the new Red Lake district of northwestern Manitoba, and has secured options on others, among them being control of the Howie Red Lake Syndicate, which holds the original discovery of the district. Very little definite information is as yet available regarding this find, but several parties have recently gone in, and as exhaustive sampling of the property will soon be completed, fuller information will be available.

Red Lake Prospectors' Syndicate Disposes of Holdings

At a meeting of the Red Lake Prospectors' Syndicate held at Ottawa on Jan. 25, the syndicate holdings were transferred to a small company, preparatory to the company being taken over by the Dunn Mines. The meeting was in full accord with the proposed sale to the Dunn.

Grover-Daley Co. Formed in Rouyn District

The Grover-Daley Co., recently organized, has taken over the property in the Rouyn district of Quebec recently held by M. B. Grover and J. Daley, of Haileybury, Ont., situated between the Amulet and the Noranda. An interesting discovery of copper-gold values has already been made. Montreal and Toronto capital is involved, and funds are already in hand for development.

Charleroi Plants Resuming Operation

The Charleroi iron and steel mills in Belgium have succeeded in persuading sufficient unskilled workmen to go to work, and many of the idle plants have been able to resume operation, according to cables to the U. S. Department of Commerce. The total Belgian production for the year 1925 was 2,541,000 metric tons of pig iron, 2,342,500 tons of raw steel, 66,700 tons of rough castings, 1,979,500 tons of finished steel, and 105,000 tons of finished iron. Production has been considerably affected by the strikes, for in 1924 Belgian plants turned out 2,808,000 tons of pig iron, 2,779,000 tons of raw steel, 81,000 tons of castings, 2,378,000 tons of finished steel, and 200,700 tons of finished iron.

London Letter

By W. A. Doman

Special Correspondent

Tin Stocks Low in England—Nigerian Deposits Promising

London, Jan. 19—At the meeting of the Barrier & General Trust, Ltd., held yesterday, James Fairbairn, chairman of the board of directors, expressed optimistic views concerning the future of tin mining in Nigeria. He pointed out that the area over which tin is being found is about 100 miles in length by an average of 20 miles in width, and that at no place has the prospector failed to discover the metal. All properties have not proved to be profitable, but with a modification of railway rates, better labor, and improved machinery Mr. Fairbairn suggested that whereas some years ago it was thought that 4 lb. per cubic yard would be necessary for an area to give good results, 1 lb. would now be sufficient; in fact, profits were being earned on this basis. It is difficult to determine the quantity of proved tin ore, but he estimates at least 60,000 tons of 70 per cent concentrates, and further states that no company has yet reached its maximum production. In consideration of the fact that tin stocks in England have been greatly reduced, he forecasts a price of at least £300 per ton for tin during the current year. Lewis Lazarus & Son state that actual stocks in the United Kingdom are at a dangerously low level and are barely sufficient for normal trading.

Harriman Produced 100,000 Tons of Manganese in 1925

In connection with the Harriman Russian manganese concession it is reported that from the beginning of operations to the end of last year about 100,000 tons has been sold to the Bethlehem Steel Co. and to the United States Steel Co., and that these two companies have placed a standing order for 30,000 tons per month. It is further reported that, as regards this Harriman concession, the Harriman interests themselves control the enterprise with a participation of 55 per cent. British interest are represented by 20 per cent, held by Baldwins, Ltd., Dorman, Long & Co., and others, the remaining 25 per cent being owned by German and other European groups.

Some time ago I mentioned the formation of the Wiluna Development Syndicate to test an area in Western Australia on the East Murchison field. This testing has been in progress for some time, and the Wiluna Gold Corporation has now been registered with a capital of £800,000. It will have the support of the existing Westralian mining companies, but a good deal of work has yet to be done to determine whether the new area will develop into a really big mine. Prospects certainly have been encouraging.

Development on the West Rand Consolidated Mines is still showing hopeful signs, and as regards the lower levels of the Battery Reef section, there is a marked improvement, though distances are still only small in relation to the great area of the property. However, 12.2 dwt. over 59 in. for a distance of 75 ft. on the 17th level augurs well.

The Coronation Syndicate, operating in the Witwatersrand, is still boring to test the property. The latest information is that the reef met in the borehole from the crosscut gave 1¼ dwt. over 27 in., but the lower section of the reef, which usually carries high values, was ground away. On the Rand there are many reefs, and the Coronation Syndicate has been active in endeavoring to discover the main one.

Johannesburg Letter

By John Watson

Special Correspondent

Transvaal Production Increased Slightly Over Previous Year

Johannesburg, Dec. 29—Statistics issued on Dec. 24, 1925, by the Union Department of Mines show the following outputs:

	1925		Eleven Months	
	November	October	1925	1924
Gold (standard price)	£3,360,872	£3,463,609	£37,450,203	£37,225,298
Silver	11,055	15,079	156,007	193,836
Osmiridium	18,449	16,280	162,263	94,938
Diamonds	680,472	767,312	7,485,749	7,485,110
Coal	327,017	313,609	3,562,753	3,498,454
Copper	14,701	44,993	452,834	452,573
Tin	53,429	21,999	273,349	271,117
Other minerals	20,376	21,974	251,998	254,764
Total value	£4,486,371	£4,664,855	£49,795,156	£49,486,090

Iron Mining Research at Houghton, Mich.

A committee of men interested in the iron-ore industry in Michigan has been invited to meet at the Michigan College of Mines, Houghton, on Feb. 5 and 6, to consider problems of research relative to iron mining in the state, including ways and means to use low-grade ores and ores with high sulphur content. The invitation has been extended by W. O. Hotchkiss, president of the college. Later it is planned to organize a similar committee of men interested in the copper industry. Five operating companies have indicated their desire to be represented on this committee, McKinney Steel, Oglebay Norton, Pickands Mather, Republic, and M. A. Hanna. Others are being invited. In this connection, Dr. Hotchkiss says:

"There are always important problems in any industry, the solution of which has a vital effect on its future. This is true at present of the iron-mining industry of Michigan. There are the obvious present problems of overproduction, and of high sulphur in some ranges. There are other problems that can be seen following these two. But most vital of all to the industry, and most important as a public problem, is the fact that we can foresee definitely that in a relatively short term of years the reserves of merchantable ore will be seriously diminished. This means that the Michigan iron-mining industry must do one of two things: It must eventually gradually disappear or it must prepare itself to use materials not now merchantable."

French Iron and Steel Output for 1925

Two more French blast furnaces were put in operation early in December last, which leads to the expectation that the output for December would bring the total production of France in 1925 to approximately 8,500,000 metric tons for pig iron and 7,450,000 tons for steel ingots and castings, compared with 7,657,000 tons of pig iron and 6,907,000 tons of steel ingots and castings in 1924, according to reports to the U. S. Department of Commerce.

Degree day at Capetown University was held on Dec. 16, when the honorary degree of Doctor of Science was conferred on Sir Robert Nelson Kotze, Vice-Chancellor of the University of the Witwatersrand. Sir Robert, for a number of years, has carried out experiments and invented a konimeter, to estimate the number of particles of dust in a given volume of mine air. His work has helped appreciably to diminish the death rate due to miners' phthisis.

Platinum Shareholders Await Mill Tests

The first ordinary general meeting of shareholders in the Potjietersrust Platinums, Ltd., was held in Johannesburg on Dec. 18. A report by a technical committee was read, giving some experimental results obtained by Prof. G. H. Stanley and T. Kapp (an expert on concentration), who had tried gravity concentration, flotation, and electro-amalgamation, the latter having given the most encouraging results.

Shareholders in the leading Transvaal platinum companies are awaiting, with much interest, the first recovery results from three or four companies now erecting pilot plants. Experiments on the Lydenburg platinum ores are now being made by Johnson, Matthey & Co., Mineral Separations, Ltd., Sulman and Picard, and the Mond Nickel Co., in England, and by experts in Germany.

The English lawn-tennis team, now on the Rand, visited the Crown Mines on Dec. 22, when they were escorted around the property, surface and underground, by the chairman, manager and members of the staff. The party then had luncheon with the managing director and Mrs. Samuel Evans.

Edmund Davis, a London mining financier, was recently elected a director of the Rhodesia Railway Trust. He contemplates a short visit to South Africa early in March. As one of the pioneers of Barberton and Johannesburg, he would be welcomed by "the old brigade."

Rustenburg Town Council decided on Dec. 21 to grant to the Lydenburg Consolidated Platinum Mines, Ltd., two years prospecting rights for £2,000. These negotiations are subject to the consent of the Administrator of the Transvaal.

Societies, Addresses, and Reports

Advocates Closer Geologic Control of Mine Operations

H. C. Boydell Thinks Profits Can Be Increased—Research in Geology Needed—Reasons for Subordination of Geologist

AN EXPOSITION of the present relations of geology to mining is contained in a paper "Economic Geology and the Mining Industry," by Dr. H. C. Boydell, of the geological department of the Massachusetts Institute of Technology. This appeared in the November bulletin of the Institute of Mining and Metallurgy, London. The author points out that mining companies generally do not use geological control in their operations to the same extent as they do specialized mechanical, electrical, and metallurgical control; and he reviews the reasons why. He emphasizes that failure to make use of competent geological supervision of mining operations in the past has meant the irreparable loss of facts and evidence which, if cumulatively observed and recorded, would have been of great value to economic geology.

Had all the data obtainable from ore deposits been systematically collected as has been done, say, with pathological facts since medicine has been practiced, our knowledge of ore deposits and the conditions of ore deposition would be much more complete than it actually is. This lack of observation and record in the past is the more aggravated in the case of mining geology, for once a mine is closed down, workings are abandoned or become inaccessible, and the chance of observation is irretrievably lost. This is the reason why, in some cases, the geologist, who is quite commonly called in consultation only during the last stages of mining operations, can regretfully do no more than hold the post mortem.

Since the executives of mining companies consist usually of level-headed men not slow to avail themselves of machinery, methods, and technical control of operations generally, there must be some reason for their not using geological control to a greater extent. Their failure to do so must be taken as a tacit admission that geological control is not considered essential. It must be remembered, however, that some mining companies do have geological staffs. The author in considering the reasons for the frequent indifference to geology in mining attributes it to these causes:

1. The comparatively easy exploration, development, and mining of rich orebodies by companies which, in the fullness of their good fortune, have no troubles and consider geological assistance unnecessary.

2. The mining of deposits of simple structural relations with uniform distribution of ore. Examples of these are coal seams, many non-metallic deposits, and the banket of the Witwatersrand.

3. The constant need for economy and consequent small staffs in the case of struggling companies (unfortunately always so common) prevents specialized geological work being undertaken.

The paper in question argues that in all these cases efficient geological control would pay for itself many times over in the saving of much useless exploration and "development" work.

The actual practice of economic geology in mining is reviewed, so as to ascertain if the service rendered to the industry is the most efficient geological science can offer; whether it is helpful and positive from the mining companies' point of view, and, if not, by what means geological control in mining can be improved. Since, other things being equal, the efficiency of any department depends on the ability, training, and experience of the men employed and the facilities for work, mining companies are reviewed with regard to the geological staffs they employ and divided into three classes:

1. Those companies requiring no special qualifications for geological work, the "geologist" being a mining engineer (usually young) with no training other than the attendance at one year's classes in general geology, mineralogy, and, possibly, elementary petrology, common to all courses in mining engineering. Mine managements that would not dream of giving a mechanical engineering graduate in the drawing office charge of their mechanical plant and would only entrust their electrical equipment to an electrical specialist have no compunction about giving geological control to a man with no special qualifications for the work.

2. Those companies employing as geologists responsible men of experience, hardworking, interested in their work and its scientific aspects, yet who are essentially mining engineers without special training in geology. From long familiarity with the area and the underground workings they know the different rocks, contacts, faults, dikes, oreshoots, details of structure, and, in short, "Know the mine," with a thoroughness that a visiting geologist, called in as consultant, can acquire only after some time.

3. Those companies employing geologists of special training and experience and assigning to them a definite measure of control of mining operations. It is under such circumstances that mining geology reaches its best development in the industry. The work done usually consists of a careful mapping of the underground workings (the care and attention devoted to this reaching a climax with the Anaconda Copper Mining Co.), the observation and direction of all development and exploration faces, and continuous preparation of stope plans and sections. In some cases the geological department is also responsible for the sampling; in others it is saddled with this and production work to an extent that considerably impairs its geological efficiency.

The writer declares that whereas in classes (1) and (2) the real geological work done is necessarily limited in its scope by the lack in special training of the men doing it, the most noticeable feature of the geological control as a whole is that it is of a purely descriptive character, useful no doubt, but entirely lacking in research; and that this marked defect is in striking contrast usually to the work done by the metallurgical department of the same company.

The general neglect of geological research in the mining industry, the author suggests, is probably a legacy of the "practical-man" period of control in mining. Although metallurgy has given mining companies, in the shape of the cyanide and flotation processes, for example, tangible and important economic results (directly traceable to research) of the value of specialized metallurgical control, geology, on the other hand, though it has afforded assistance to mining, has not provided advances of anything like the same degree of applicability or indispensableness. The assistance that it has rendered, moreover, has not been free from the suspicion in many cases that the advantages actually offered were as much the result of mining operations as they were the work of geologists. The idea is quite prevalent in mining circles, and correct to a certain extent, that the geologist is mainly dependent on the evidence disclosed by the pick and the drill hole for his ability to assist in mining; and that consequently his purely geological methods of research are useless. This is responsible in a measure for the indifference of mining companies to mineralogical and petrographic investigation of their problems. Geologists themselves are partly to blame; their work in connection with ore deposits has been too largely merely descriptive; their power of satisfactory explanations has not increased proportionately with description. There has been too much theorizing and a noteworthy absence of chemical and physical research (as distinguished from mineralogical and petrologic) in the economic geology of ore deposits. The result is that the mining man seeking assistance from geology and finding so little positive knowledge or information available loses faith in the geologist's theories and his ability to predict apart from his interpretation of evidence afforded by mine exploration. On such evidence, too, many mining men consider they are as well able to predict in particular cases as a geologist.

The paper stresses the point that, since in the last analysis geology is essentially dependent on chemistry and physics, the need is for research in geological chemistry and physics which must supplement (but not supplant) the usual researches in paleontology, mineralogy, petrology, and tectonic geology. Such research will, however, involve physics and chemistry of the most difficult and advanced kind. Temperatures and pressures will be higher than usual, surface phenomena will have to be considered, and all this will mean incursions into the very forefront of modern research in molecular physics and chemistry. Therefore it is

that the question is asked, Who is to undertake such research? The author concludes that the geologist himself will have to turn chemist and physicist and undertake it, since he best understands the peculiar problems of his own science.

With regard to the financing of the research, it is concluded that as equally essential research in other branches of industry has been provided for by the industries concerned, the mining industry must do likewise. The willingness of mining companies to contribute to such research is discussed and the example of the General Electric Co. in maintaining general research (as distinguished from industrial) is held up as an example. To the probable objection to this example being followed by mining companies for the reason that a mine has only a short life, whereas the General Electric Co. has an indefinitely long one, there is at once available the facile reply that, although mines may have short lives, still mining has to go on. The world's mineral supply not only has to be maintained but increased, but smelting companies have to be kept supplied with ore, and the many mining companies seeking to prolong their lives by finding new mines require all the possible assistance they can get from geology in doing so.

In connection with the question as to where the research work is to be done, the author considers that for various reasons it will have to be done elsewhere than at the mines. Some of the broader phases of the work might be carried out at the National Physical Laboratory, at Teddington, or at the Geophysical Laboratory, at Washington, but probably more immediate results will be obtained if the main part of the work be done at those universities where the necessary equipment is available. In the United States the division of industrial co-operation and research of the Massachusetts Institute of Technology was created by its late president, Dr. Maclaurin, for just such a purpose as this. Wherever done, it is very important that the practical objective of the work shall be kept constantly in mind, and for that reason the research workers should be kept in close touch with actual ore deposit conditions and problems, and be familiar with ore deposits generally and conversant with field and mine relations.

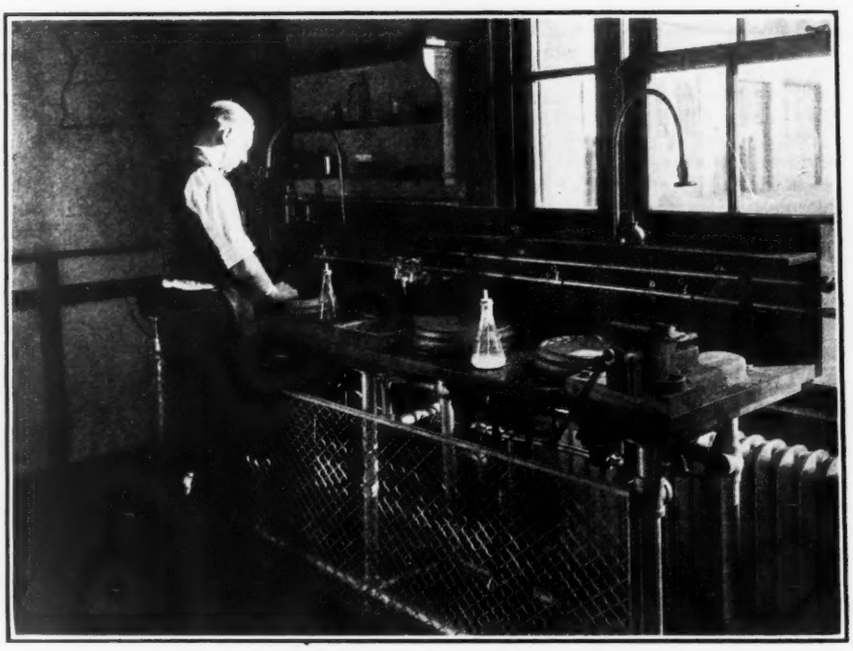
As time goes on assistance in the research will come from purely academic sources. This may be more directly concerned with the fundamental problems, since advances in these usually spring from academic soil. The universities can, and no doubt also will, assist by carrying out essential teaching in geological chemistry and physics for the training of future geologists, to whom a sound knowledge of these hitherto neglected but very important subjects is sure to be of growing importance.

Mining executives, geologists, mining engineers, and others connected with mining will find that the paper probes a weak spot in the mining industry and advances the theory that many mining companies are not at present availing themselves of the best that geologial science can offer them in the control of their operations.

Bureau of Mines Opens New Pittsburgh Metallurgical Laboratories

Electric Furnace Department Feature of New Plant—Co-operative Work With Carnegie Institute

The opening of the new metallurgical laboratories of the Pittsburgh Experiment Station of the Bureau of Mines, on the evening of Jan. 26, was made the occasion of an important function. Members of the Metallurgical Advisory Board of Carnegie Institute of Technology and of the Bureau of Mines were present. Others prominent in the mining and metallurgical fields also attended.



New metallographic laboratory of the U. S. Bureau of Mines at Pittsburgh, Pa.

The new metallurgical laboratories are the outgrowth of an agreement made in 1923 under which Carnegie Institute of Technology appointed an advisory board for its Department of Metallurgy and arranged for co-operative research fellowships in metallurgy at the Pittsburgh Experiment Station of the Bureau of Mines. Under the arrangement, certain problems in the metallurgy of iron and steel formerly conducted at the Northwest Experiment Station of the Bureau of Mines, Seattle, Wash., are being studied at Pittsburgh. In the study of these problems, the well-equipped laboratories of Carnegie Institute of Technology will be available to supplement those of the Bureau of Mines.

Among the technical problems that are being studied by the newly established metallurgical section are the melting of sponge iron; reduction and carburization in iron smelting; mill-ball compositions and preparations; abnormality in case carburized steels; non-metallic inclusions of steel; and requirements for open-hearth refractories.

In the study of these problems the large technical staff of the Bureau of Mines will be assisted by members of the faculty of Carnegie Institute of Technology and by the members of the Metallurgical Advisory Board, which is composed of prominent metallurgists connected with the industrial organizations of the greater Pittsburgh district. Some of the investigations will be conducted largely in operating plants in and near Pittsburgh. Other agencies in close proximity that will help facilitate the work are the University of Pittsburgh, the Mellon Institute, and the Carnegie Library.

The equipment of the new metallurgical laboratories includes a modern electric-furnace laboratory well arranged for fundamental work in many branches of the metallurgy of iron and steel; a metallographic laboratory; and, in addition a chemical laboratory also.

The metallurgical section of the Pittsburgh Experiment Station is under the general supervision of D. A. Lyon, assistant director and chief metallurgist of the Bureau of Mines, and S. P. Kinney, the supervising ferrous metallurgist. The latter correlates all of the ferrous work of the Bureau and conducts blast-furnace investigations. The work of the metallurgical section is directly in charge of the section chief, C. E. Sims, who is also the electrometallurgist of the Bureau, and who handles work pertaining to electrometallurgy or the electric furnace.

F. W. Schroeder, a chemist, who has done graduate work in ceramics and extensive research work on refractories, will handle the work of the section having to do with the metallurgical requirement of refraction. B. M. Larsen, a chemical engineer who has specialized in metallurgy, will conduct research problems in the metallurgy of steel. A. K. Hutton handles the analytical work.

The metallurgical section at Pittsburgh is one of the three metallurgical sections of the Bureau working on ferrous metallurgy, the other two being at Minneapolis and Birmingham.

Men You Should Know About

H. Hardy Smith is now with the Taio Gold Mining Co., at Akasaka-Ku, near Tokyo, Japan.

Dean Dexter S. Kimball of Cornell has been elected president of the American Engineering Council.

W. Spencer Hutchinson arrived in New York last week after an absence of several months abroad.

George H. Garrey, mining geologist and engineer, sailed on Jan. 30 for Europe. He expects to be abroad about three months.

M. Victor Babet, a French geologist, has been officially designated to prosecute geological research in French Equatorial Africa.

Jay A. Carpenter, industrial engineer for the Pacific Portland Cement Co., recently visited the Gerlach plant of his company from his Los Angeles headquarters.

J. L. Fearing, formerly geologist for the United Verde Extension Mining Co., has accepted a similar position with the Moctezuma Copper Co. at Pilares, Sonora, Mexico.

Felix A. Vogel, consulting geologist, of San Antonio, Tex., has returned to his office after eighteen months of geological work in California and the Rocky Mountain region.

Frank J. Buck has resigned from the staff of the Consolidated Minerals Corporation, Tujunga, Calif., to accept a position as superintendent of the operations of the Zonolite Co., at Libby, Mont.

Robert D. Adams, of San Francisco, president of the Venezuela Gold Mining Co., returned from Venezuela recently because of ill health. Mr. Adams will go to San Francisco, to remain until he has recovered.

N. A. Timmins, president of the Hollinger mine, is in the Rouyn district inspecting the Waite-Montgomery property, which he controls, and the Amulet and Noranda mines, in which he is largely interested.

Horace Young, formerly manager of the Harker gold mine, has been appointed manager of the Castle Tretheway silver mine, of Gowganda, northern Ontario, in succession to Murray Kennedy, who recently resigned.

L. Ehnbom, after spending five years in the Magdalena mining district, Jalisco, Mexico, has returned to the United States to accept the position of superintendent of development for the Ely-Calumet Mining Corporation, at Ely, Nev.

M. A. Randall, formerly chief chemist of the Aguascalientes plant of the A. S. & R. Co., has associated himself with the Chemical Laboratory of R. T. Wilder, of Chihuahua. The firm name is now Wilder & Randall, Apartado 33, Chihuahua, Mexico.

Albert Silver, secretary and operating director of the Tonopah Premier Mining Co., has been in Mexico for the last three months, working on a metallurgical problem for the San Luis Mining Co., and will probably remain there at least three months longer.

E. E. Fitz-Henry, formerly one of the representatives of Minerals Separation, Ltd., in South America, has started business as consulting engineer on his own account with office and experimental metallurgical laboratory at Calle Lira, 3, Casilla 202, Santiago, Chile, South America.

George A. Kervin, who was appointed smelter superintendent for the Mason Valley Mines Co. at Wabusca, Nev., soon after the U. S. Smelting closed its Mammoth smelter at Kennett, Calif., of which he was in charge, has been appointed general manager for the Mason Valley Co., succeeding the late Emmet D. Boyle.

A. W. Allen

A. W. Allen, formerly on the editorial staff of *Mining Journal-Press,* and more recently editorial representative of *Chemical and Metallurgical Engineering* in the Pacific Coast region, has resigned to resume engineering practice and has accepted an appointment on the technical staff of Antony Gibbs & Co., in connection with nitrate operations in Chile. Mr. Allen plans to sail for Valparaiso from California late in February.

T. F. Sutherland, Chief Inspector of Mines for Ontario, who was commissioned by the government to visit the South African mining fields to obtain information as to how to combat the dangers arising with the expansion of the mining industry, has returned with a number of suggestions for amending the mining regulations.

Jesse J. Mac Donald, mining engineer, has recently been engaged in rearranging the apparatus at the 300-ton cyanide plant of the Presidio Mining Co. at Shafter, Tex. After returning to El Paso, Tex., he will go to Mexico to fulfill professional engagements to conduct milling and metallurgical work for companies operating in that country.

Don Rait, mine superintendent for the Calumet & Arizona Mining Co., operating in Arizona, has announced the promotion of **A. J. Balmforth** from chief engineer to superintendent of the 85 Mine at Valedon, N. M. **Harry Lavendar,** now foreman of division B of the Junction mine, at Bisbee, will become chief engineer, and **Leroy Walton** will assume the duties of the position left vacant by Mr. Lavendar.

Oscar N. Hershey, mining engineer and geologist of San Francisco, has been engaged in geological work at the Tybo district, 60 miles northeast of Tonopah, Nev. This property is under option to the Bunker Hill & Sullivan and the Treadwell interests, and **W. H. Blackburn,** formerly manager of the Tonopah Mining Co. property in Tonopah, is engaged in unwatering and sampling the old Tybo property for these interests.

Obituary

Frank X. O'Brien, veteran mining man and pioneer of the Phœnix and Wickenburg districts, of Arizona, died on Jan. 25, after an illness of about two years. Mr. O'Brien was the owner of a number of mining properties in the Wickenburg district, one of them the O'Brien mine, situated 30 miles from Wickenburg. Mr. O'Brien is survived by his widow and four children.

William E. Sharon, San Francisco and Nevada capitalist, died recently at Piedmont, Calif. He was seventy-three years old. Sharon was a nephew of William Sharon, famous Comstock Lode financier. He had been a member of the state senate in Nevada, and was a charter member of the Reno Lodge of Elks. Surviving are a widow and five children.

Joseph Chauvin, veteran mining man and broker, one of the pioneers of Butte, Mont., died in that city on Jan. 23 at the age of seventy-seven. Mr. Chauvin was born on a farm near Shelburn, Vt., in 1848. He came to Montana in 1881 and was active as a mine owner and later as one of the prominent mining stock brokers of the old Butte Stock Exchange. He was active in lodge and social affairs and served as delegate to many of the county, city, and state Republican conventions. Survivors include a daughter, Mrs. W. M. Jermain, of Missoula, Mont., and a son, Frederick Chauvin, of New York City.

D. L. Doolette, who had been closely identified with mining interests in Australia for many years, died in Perth, Western Australia, early in December, 1925, at the age of fifty-three years. Mr. Doolette was born in South Australia, where, after going through the arts course at a local university, he abandoned study for the medical profession to "carry his swag" in the great rush to Western Australia. There he pegged out the claim which afterward became famous as the Golden Horseshoe lease, and had a wide experience generally of the Western Australian mining fields. In 1910 he was managing a mine at Mount Garnet, when the Bullfinch was discovered by one of his prospectors. Of this rich mine he became almost the entire owner. Mr. Doolette was instrumental in the introduction into Western Australia of a large amount of English and Eastern States capital for mining development, and formed more prospecting syndicates than any other man in the history of Western Australia.

Recent Technical Publications

Reviews, Abstracts, and References

Electrical Prospecting—Development of electrical prospecting methods in Sweden and the discoveries made by such means in the last few years are described in a new bulletin (No. 327) of the Geological Survey of Sweden, entitled "Electrical Prospecting in Sweden," by K. Sundberg, Hans Lundberg, and J. Ecklund. The earlier bulletin, "Practical Experience in Electrical Prospecting," by Hans Lundberg, which the Survey issued in 1922, summarized the results of research and practical work done up to that time. Since then, considerable advance in the development of the science is said to have been made and some new ore deposits that do not come to the surface have been found.

The chapters on the theory and practice of electromagnetic and auxiliary methods have been prepared by Mr. Sundberg, according to the preface; those on potential methods by Mr. Lundberg; and the geological portions by Mr. Ecklund. About half of the bulletin is taken up by the excellent concise description of the methods employed. The rest is given over to a discussion of the practical results.

Sweden has four ore-bearing districts of importance: northern Lapland or Norrbotten, chiefly an iron ore district; central Sweden or Bergslagen, containing magnetic iron and sulphide ores; the Skellefte district; and, last, the Västerbotten Mountains, the latter two being in southern Lapland. Norrbotten and Bergslagen have long been known, and only recently has electrical prospecting been done there. On the other hand, the two districts in southern Lapland have been discovered in recent years essentially by means of electrical prospecting in conjunction with geological investigations. It is with the results obtained in these last two regions that the pamphlet deals. Eight geological and electrical maps are included as inserts. The bulletin may be obtained from the Geological Survey of Sweden (price, five kroner), Stockholm, or through the Swedish American Prospecting Corporation, 42 Broadway, New York, N. Y.

Copper Refining—M. H. Merriss has prepared a paper for presentation at the February, 1926, meeting of the A.I.M.E. on "Improvements in the Series System of Electrolytic Copper Refining Recently Developed by the Nichols Copper Co." (Twenty pages; obtainable for 25c. from the American Institute of Mining Engineers, 29 W. 39th St., New York City.) The series system is used at only one other refinery in the United States, that at Baltimore.

Foreign Commerce — The Foreign Commerce Department of the Chamber of Commerce of the United States, Washington, D. C., has issued for free distribution a 36-page "Foreign Commerce Handbook," for 1926-1927. It is a self-indexing answer to hundreds of questions about export and import trade and a guide to the best sources of information and service.

Garnet—The production of garnet has become a well-established industry in recent years, though not a great deal has been published regarding it. The U. S. Bureau of Mines has just issued a comprehensive bulletin on the subject, No. 256, entitled "Garnet: Its Mining, Milling, and Utilization," by W. M. Myers and C. O. Anderson. Much information is given that will be useful to all those interested in the subject, from prospectors to users, and a selected bibliography is appended. Altogether, the job seems particularly well done. Copies are obtainable for 15c. each from the Superintendent of Documents, Washington, D. C.

Shaft Sinking—A. Job is the author of an 11-page paper on "The Sinking and Equipment of the Ventilation Shaft of the Government Gold Mining Areas," in the December issue of *The Journal of the South African Institution of Engineers.* (Johannesburg; price 2s.) To improve the ventilation of this mine it was decided to sink a circular shaft 22 ft. in diameter and equip it on the surface with a fan capable of inducing a flow of 900,000 cu.ft. of air per minute through the mine workings. The distance sunk, in a little less than eleven months, was 2,664 ft. Considerable difficulties from water were surmounted.

In the bulletin just mentioned is also further discussion on the paper of A. L. Egan. "The Design of Tips for Skips for Vertical Shafts."

Indian Mining—The report of the Chief Inspector of Mines in India for the year 1924, 146 pages, has recently been issued and may be obtained for 4s. 6d. from the Office of the High Commissioner for India, 42 Grosvenor Gardens, London, S. W. 1, England. It is principally devoted to statistical matter.

Copper Deposition — "Chemistry of Deposition of Native Copper from Ascending Solutions" is discussed by Roger C. Wells in U. S. Geological Survey Bulletin 778, 71 pages. This bulletin is the result of work of a chemical nature carried out by the Survey in an effort to prove or disprove certain theories offered by geologists relating to the presence of copper in the Michigan deposits. Each of the experiments is briefly described, and critical comments offered. Copies of the bulletin are available from the Superintendent of Documents, Washington, D. C., at 15c.

Economic Geology—Bulletin 780-B of the U. S. Geological Survey, Washington, D. C., 126 pages, with maps, is by H. W. Hoots and is a discussion of the "Geology of a part of Western Texas and southeastern New Mexico, with special reference to salt and potash." The United States has here potash reserves of probable commercial value, within practical reach of the surface. The next stage in the search, it is said, will no doubt be exploration by core drilling, or even the sinking of shafts, to determine the size of the deposits that have already been located. Copies of this bulletin are obtainable from the Survey.

Oil Shales—Four papers on the oil shales of Kentucky, bound with three papers on other subjects, have recently been issued by the Kentucky Geological Survey, Frankfort, Ky., as Vol. 21, Series VI, of its publications. These are: "Microscopic Examinations of Kentucky Oil Shales," by Reinhardt Thiessen; "The Precious-Metal Content of the Black Devonian Shales of Kentucky," by C. S. Crouse; "An Economic Study of the Black Devonian Shales of Kentucky," also by Mr. Crouse; and "Some Mother Plants of Petroleum in the Devonian Black Shales," by David White and T. Stadnichenko.

Summarizing, Mr. Thiessen says that the Devonian shales are of the spore type, being composed essentially of organic matter and pyrite embedded in clay. The organic matter consists mainly of spores, the amount of spore matter relative to the total organic matter being a good index of the shale's richness. Mr. Crouse, influenced by the publication in 1922 of a paper by Thomas Varley, of the U. S. Bureau of Mines, in which Mr. Varley discussed the presence of gold and silver in Western oil shales, undertook to discover in what quantity the precious metals occurred in Kentucky's Devonian shales. The results are given in his paper. Several series of samples showed that gold and silver were present in practically all of the oil shales of the state, but, so far as determined, in small amounts that are of no commercial importance.

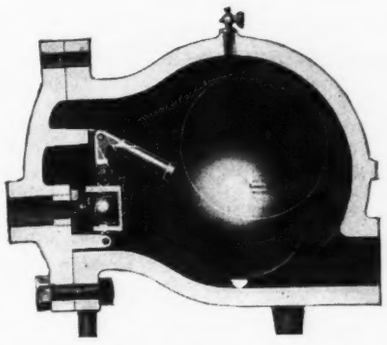
In Mr. Crouse's second paper, summarizing the results of his economic study, he says that in all respects save oil content the oil shales of Kentucky show marked superiority over those of the Western states from the viewpoint of commercial operation, and that Kentucky is the logical place for the birth of the oil-shale industry in the United States. Messrs. White and Stadnichenko, in their paper, conclude that further study of fossil plant remains in the Devonian shales will throw great light not only upon the origin of petroleum in the Devonian of the Appalachian trough but upon the fossil plant products and remains responsible for the different characters and qualities of the distillates initially.

The remaining papers are: "Geology of Woodford County, Kentucky," by Arthur M. Miller; "The Intrastate Industrial Utilization of the Mineral Resources of Kentucky," by Mr. Crouse; and the "Geology of Jeptha Knob," by Walter H. Bucher.

Compressibility of Gases—The U. S. Bureau of Standards has issued a series of charts for computing the compressibilities of air, helium, hydrogen, methane, neon, nitrogen, and oxygen, and for computing the volumes delivered from cylinders at high pressures. The graphs are the work of S. F. Pickering. The pamphlet, which is Miscellaneous Publication No. 71, is obtainable for 10c. from the Superintendent of Documents, Washington, D. C.

Federal Trade Commission — H. A. Toulmin, Jr., has written a booklet of 56 pages entitled "Bothering Business," which is a severe criticism of the Federal Trade Commission. The book is published by the B. C. Forbes Publishing Co., 120 5th Ave., New York City.

New Machinery and Inventions



A steam trap of simple design that is either completely shut or wide open

Ball Seat Steam Trap Actuated by Float

When a steam trap is open it should be wide open. When it is closed there should be no leakage. Furthermore, the trap should be simple. The steam trap shown in the cut is said to meet these three specifications in every particular. It has few parts and only two positions: completely shut and wide open. The trap was designed and developed by a practical steam engineer expressly to overcome the troubles that he had experienced in his own plant. It is now being manufactured and marketed by the Williams Gauge Co., Pittsburgh, Pa., and is known as the "Williams new ball seat trap No. 4B."

The ball valve of the trap is held absolutely closed and leakless when the float is in the position shown in the cut. The float is made of welded chrome nickel tested at 600 to 1,200 lb. per square inch. As the water in the chamber rises, the float rises also, but the trap does not open immediately. The designer purposely made an amply large cage for holding the ball so that there is about an eighth of an inch "lost motion" or "play" between the ball valve and its cage. Therefore the ball is held in place by the pressure in the trap body until the float rises to the position shown dotted. When the float is in that position the cage finally is able to pull the ball away from its seat.

As soon as the ball leaves its seat the pressure is equalized and the ball moves to the back of the cage, as shown in its dotted position, leaving the outlet wide open so that the discharge is quickly accomplished. There can be no wire drawing with such a design as this. As the water discharges the float then lowers again, and when the water has reached a point 3 or 4 in. above the outlet the float is back to its initial position, as shown in the photograph. This action of the float tips the cage forward to a point where the ball is caught by the water being discharged, and the valve closes with a snap. Once closed there is no possibility of leakage. Tightness is assured because the ball and seat fit accurately and both are made of Monel metal. The ball and seat are removable and easily renewable.

An Improved Cable Connector

A new cable connector intended for motor and armature leads on mine locomotives, for cable connection to trolley poles, or for cable leads to any stationary or portable motor has been announced by the Ohio Brass Co., Mansfield, Ohio. This connector takes the place of a permanent connection that might otherwise be used, yet has the advantage that it can be quickly disconnected. It has two phosphor-bronze terminals, which are soldered onto the cable ends. Insulation is trimmed back just far enough so that the distance between ends of the insulation is slightly less than the length of the tight-fitting rubber sleeve. When terminals are snapped together, with the rubber sleeve in place over the joint, a continuous and tight rubber-insulated joint is formed, requiring no taping.

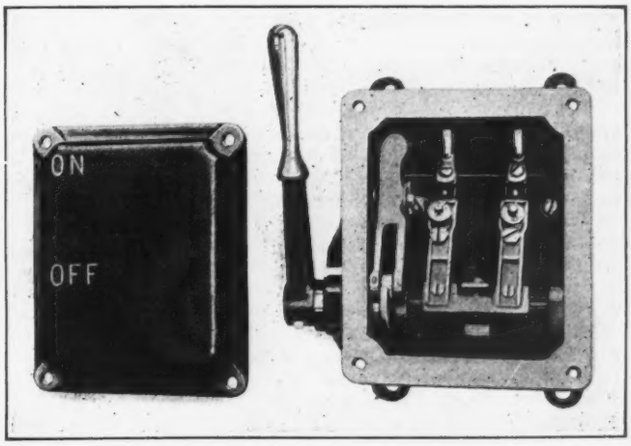
Master Switch Protected Against Moisture and Acid Fumes

For those places where it is thought desirable to protect electrical apparatus against moisture and acid fumes, the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has introduced the control station shown in the accompanying photograph. The mechanism is inclosed in a cast-iron case, and has a cover fitted with a gasket, which excludes all moisture and fumes. A stuffing gland fitted to the shaft provides a tight fit, and the thick wall of the cast-iron body allows enough threads for a tight conduit or pipe connection.

Contact is made on the brass cylinder by two heavy fingers of standard non-stubbing design. These fingers are mounted on asbestos lumber and are zinc-plated, as are all other small parts. The contact tips are of heavy bar rolled copper. The fingers are of sufficient capacity to permit the use of this master control station on any pilot circuit at all commercial voltages.

The large polished brass handle gives a convenient grip to the average operator. It extends far enough from the case to indicate whether the station is open or closed. All parts are generously proportioned, to reduce chance of breakage in rough handling.

All parts of this master switch are generously proportioned to reduce chances of breakage. The case is sprayed with protecting paint to help it withstand submersion in water or the effect of acid fumes



Preventing Boiler Scale by Electrial Means

An electrical means of preventing the formation of boiler scale has recently been patened and is now being introduced to industry by the International Process & Engineering Corporation, 42 Broadway, New York. The method is based on the discovery that a minute quantity of electrical energy passed through a boiler will cause crystallizing salts to be thrown out of solution as a soft mushy sediment, instead of being permitted to form a hard scale. The sediment can easily be removed by blowing off the boiler. Further discovery is alleged by the company that if the current is caused to fluctuate the scale particles produced will be smaller and softer. The system, which is known as the "Agfil" system, thus operates on the minute electrical effects associated with crystal formation and growth and in a field where thousandths of a volt are found to be effective.

The minute quantity of electrical energy necessary is generated in a thermopile that is connected in closed circuit with the opposite ends of the boiler shell. A mechanical device to increase and decrease, alternately, the flow of current through the boiler shell from (for instance) 0.075 amp. to 0.05 amp. is incorporated in this circuit to produce the desired fluctuation. For convenience in observing the amount of current passing through the boiler, a milliammeter is usually connected in the circuit between the thermopile and lower connection to the boiler shell.

Electric Chain Hoist Improved

A new ball-bearing electric chain hoist has been added to its line by the Yale & Towne Manufacturing Co., of Stamford, Conn. The new model (No. 20B) is designed to withstand shock loads so common to this class of equipment, all suspension members being of the best steel. To make it readily adaptable to any overhead system, the hoist has been made so that the side plates of the trolley carriage can be spaced on steel bars to fit the desired beam flange. The mechanism is inclosed in oil-tight chambers and is compact and easily accessible for inspection. The ball-bearing load sheave provided helps decrease the current consumption and increase the efficiency.

The Market Report

Metal Market Has Improved Tone

Copper, Zinc, and Tin at Somewhat Higher Levels Than a Week Ago, Both in New York and London

New York, Feb. 3, 1926—The total volume of business done on the metal markets during the week ending today has not been particularly impressive, but prices of copper, zinc, and tin are somewhat improved, and lead has held steady, with supplies scarce. Business conditions are somewhat improved in Europe, according to most observers, and the prices of all metals were higher today in London than they were a week ago, with the exception of zinc.

Copper Goes Above 14c.

The demand for copper has improved, and the volume of sales has been well above the meager tonnage of last week. On Thursday, Friday, and Saturday some sellers continued to cut under the 14c. level for Connecticut and near-by deliveries, sales being made as low as 13.925c., delivered, for March-April. By Monday, however, practically everyone had come up to 14c., and yesterday afternoon and today, after selling a good tonnage at that price, some producers refused to release any more for less than 14¼c. All offerings at 14c. had apparently disappeared this morning, though a fair tonnage was obtainable and was sold at 14.075c. Business in the Middle West has been better than usual, and on Saturday, Monday, and Tuesday, several million pounds were sold at 14.10@14.125c. Manufacturers in the Middle West are reported extremely active, though most of their orders are for small lots.

Sentiment is distinctly better in the copper market; perhaps more than is indicated by the slightly improved prices. It is felt that European conditions are on the mend and that the recent unsatisfactory demand there, described more at length on page 270 of this issue, is likely to show a pronounced improvement in the coming months. Then, too, the rumors of a better organization of the copper market, which first saw the light in a Boston financial paper, seem to have been a bullish factor. Export prices today got as high as 14.10@14.125c., f.a.s., and 14.30c., c.i.f. A fair amount of business has been done in the last week, at from 5 to 15 point concessions from these levels.

Lead Stronger in the West

At current price levels the lead market in the Middle West is stronger than in New York. The principal demand is for special brands, of which very little

Daily Prices of Metals

Jan.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N.Y.	St. L.	St. L.
28	13.70	60.125	61.00	9.25	9.075@9.10	7.95
29	13.75	60.00	60.75	9.25	9.075@9.10	8.00
30	13.70 @13.875	61.025	61.125	9.25	9.075@9.10	8.00
Feb. 1	13.70 @13.875	61.00	62.00	9.25	9.10	8.00@8.05
2	13.70 @13.875	61.00	62.00	9.25	9.10	8.00@8.10
3	13.825@13.875	61.25	62.25	9.25	9.10	8.00@8.075
Av.	13.777	60.583	61.521	9.250	9.094	8.010

*The prices correspond to the following quotations for copper delivered: Jan. 28th, 13.95c.; 29th, 14.00c.; 30th, Feb. 1st and 2nd, 13.95@14.125c.; 3rd, 14.075@14.125c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
28	58	59	64½	275¼	271½	34	33 13/16	36⅝	36⅜
29	58	59⅛	64¾	274	270¾	34 3/16	33 15/16	36⅞	36 9/16
Feb. 1	58½	59½	65	279⅝	274½	34 7/16	34 3/16	37 1/16	36⅝
2	58⅝	59¾	65¼	279¼	274⅜	34 5/16	34	37⅛	36 11/16
3	59¼	60¼	65¾	279½	275¼	34⅛	33 13/16	36 13/16	36⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

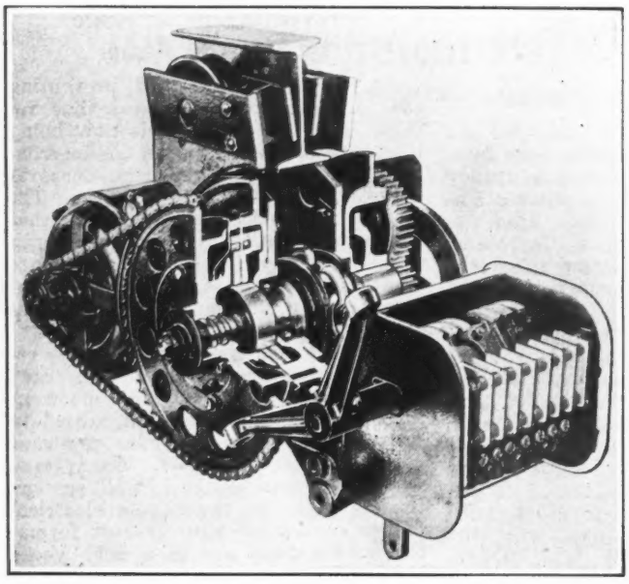
Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Feb.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
28	4.85⅜	67⅛	31	84s10½d	1	4.86	67	30 13/16	84s 9¾d
29	4.85⅞	67	30 15/16	84s 9¾d	2	4.86	67¼	31⅛	84s10½d
30	4.85¾	67	30 15/16	....	3	4.86	67⅛	31	84s11½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Average Metal Prices for January, 1926

Copper:	
New York Electrolytic	13.822
London Standard Spot	59.013
London Electrolytic Spot	65.325
Lead:	
New York	9.255
St. Louis	9.102
London Spot	34.778
London Forward	34.584
Silver:	
New York	67.795
London	31.308
Sterling Exchange	485.295
Zinc:	
St. Louis	8.304
London Spot	38.059
London Forward	37.363
Tin:	
99 per cent	61.415
Straits	62.275
London	282.038
Quicksilver	87.960
Antimony	23.490
Platinum:	
Refined	118.20
Crude	113.20
Aluminum, 98 per cent.	27.000



Sectional view of new electric chain hoist. Increased efficiency and decreased power consumption are obtained by the use of a ball-bearing load sheave

This sheave is surrounded with large chrome-vanadium-steel ball bearings to reduce friction. It is ground on an arbor to give perfect concentricity for the ball races and is bronze-bushed for the driving pinion. This pinion is machined from a single drop forging and then heat-treated. Welded-steel chains can be furnished, also containers to hold any length of slack chain for ¼-, ½- and 1-ton hoists and 30 ft. for the 2-ton hoist.

New Malleable Iron Withstands Hot-Dip Galvanizing

A new metal, which it has called "Flecto" iron, has been developed by the Ohio Brass Co., Mansfield, Ohio. This is a type of malleable iron which, by virtue of a heat-treating process, is freed from all tendency toward embrittlement when hot-dip galvanized. While retaining all of the desirable characteristics of malleable iron, the Flecto process is said so to improve the metal that it is considered to be practically a new metal. This announcement has just been made by the company, but it is understood that all malleable iron castings produced by it in the last two years have been treated by this process. During this period the metallurgy of this new metal had been thoroughly proved by its use in the field.

The most valuable characteristic of the new iron is that it withstands galvanizing by the hot-dip method without any tendency to become brittle. Hot-dip galvanizing has long been recognized as the best method of rust-proofing castings. However, ordinary malleable castings are very frequently embrittled by galvanizing. As a result, many substitute methods of rust-proofing have been resorted to, but experience has shown the great desirability of hot-dip galvanizing if the bad effect upon the iron could be overcome. This has now been accomplished in this new iron, whose main characteristic is that it always retains its malleable properties. The process for making Flecto iron is patented, but is to be licensed under liberal terms, according to the company.

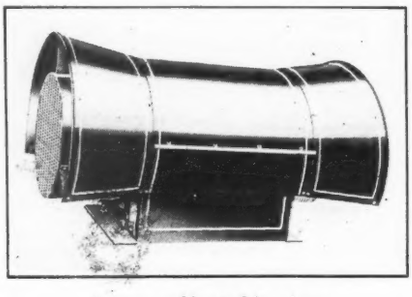
Adjustable Horn Siren Is an Efficient Noise Maker

Sirens have been used as a substitute for bells or steam whistles at electrically operated mines for many years. By and large, these machines have given excellent satisfaction. In several respects, however, they have been much improved in detail. Thus the double-head type B siren as now built by the Federal Electric Co., 8700 S. State St., Chicago, Ill., has several new features.

In the latest model a 5-hp. motor operating at 3,000 to 3,500 r.p.m. is used. The fans or rotors that generate the sound are of 15-in. diameter. A bent steel plate is used as a motor footing or base which lightens the machine and makes it easier to erect than the older machine with its cast-iron base.

Probably the greatest improvement in this device, however, and one that has been patented is the double horn effect over the slot openings. By means of this double horn the incoming stream of air is separated from the outgoing stream, the friction of the two currents being thus reduced to a minimum. This materially increases the efficiency of the machine as well as the effectiveness of the sound emitted.

In this arrangement also the outer horn is adjustable; that is, it may be rotated so that a directional effect upon the sound can be obtained. This feature, which also has been patented, is an especially important consideration at mines because in many cases the village layout and local topography are such that it is necessary to project sound in only one direction.



A new adjustable siren

Trade Catalogs

Drills, Compressors, etc.—The following new catalogs and booklets have been received from the Sulllivan Machinery Co., Chicago, Ill.:

"Speed Up With Air"; 16 pages. A road-builder's and contractor's booklet, illustrating Sullivan portable air compressors, and many applications of rotator hammer drills, clay spaders, concrete breakers, portable hoists, etc. Tables of capacities and specifications are given.

Bulletin 81-I; 12 pages. This covers Sullivan concrete breakers, featuring two new types: DW-221, 75-lb. heavy-duty "Buster," and the 48-lb. DP-221 light "Buster," for concrete breaking in street opening, demolition work of many kinds, etc. The term "Buster" has just been registered as a trademark to designate this type of tool.

Bulletin 81-J; the Sullivan clay spader; 8 pages. A number of interesting pictures of this compressed air tool at work are shown.

Bulletin 72-I. This covers the Sullivan Class C All Hammer light sharpener. This compressed air machine weighs only 1,100 lb. and takes only about 15 per cent as much compressed air as the previous type, but will make bits on ⅞- or 1-in. steel up to 2½-in. gage.

Bulletin 81-H. The JC automatic line oiler for rock drills and hammer drills.

Bulletin 74-B describes the Sullivan standard oil and gas drill-steel heating furnace, including mention of the magnetic indicator for determining the critical point in heating steel for tempering.

Bulletin 83-B. A new edition describing single-stage belt-driven air compressors, Class WG-6.

Bulletin 81-K. A new edition, describing plug drills for granite quarries.

Furnace—Catalog FF-1 of Combustion Engineering Corporation, New York, describes a new water-cooled furnace, the C-E Fin furnace, which, the company claims, eliminates wall maintenances and increases boiler capacity.

Chain Hoists—Yale & Towne Manufacturing Co., Stamford, Conn., has issued a folder covering electric ball-bearing chain hoists.

Boiler Scale Prevention—The "Agfil" electrical system is described in a pamphlet of the International Process & Engineering Corporation, 42 Broadway, New York.

Cable Connector—A new O-B cable connector for motor and armature leads on mine locomotives, for connections to trolley poles or for motor leads, is announced in a folder issued by the Ohio Brass Co., Mansfield, Ohio.

Welding—Bulletin GEA-9 of the General Electric Co., Schenectady, N. Y., is devoted to arc welding sets consisting of a 200-amp., self-excited arc welding generator, with control, driven by a 22½-hp. four-cylinder heavy-duty Buda engine.

Ball Mills—The Hardinge Company, York, Pa., has issued Catalog No. 13A, covering Hardinge conical ball and pebble mills and their application to the field of grinding and pulverizing.

London, 3s. 9d.@4s. 3d. for 99 per cent ingots or sticks.

[1]**Molybdenum**—99 per cent, $25 per kg.; C. P. metal, $80 per kg.

Monel Metal — Base price for shot, 32c. per lb.

Nickel—Ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). Market firm. London, £170@£175 per long ton, according to quantity.

Osmium—$100 per oz.; London, £23 10s.@£25 10s.

Palladium—$78@$82 per oz. Crude, $60@$65 per oz. London, £17, nominal.

Platinum — Refined, $115 per oz. officially quoted. Sales also at $110@$112. Crude, $109.

London, £23 10s. per oz. for refined, and £22 for crude. Demand limited.

Quicksilver—Per 75-lb. flask, $87. London, £14 15s.@£15. San Francisco wires $90. Market is steady.

Radium—$70 per mg. radium content.

Rhodium—$80@$95 per oz.; London, £18@£22.

Ruthenium—$95@$100 per oz.; London, £16½@£19½.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $1.95 per lb. in ton lots.

Tellurium—$2 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $6 per lb. in 25-lb. lots.

Tungsten Powder—97 to 98 per cent pure, $1.18@$1.20 per pound.

[1]**Zirconium Metal**—98 per cent grade, per lb., $30, in 5 to 10 lb. lots.

Metallic Ores

Chrome Ore—Crude, 45 to 50 per cent Cr_2O_3, $22.50@$23 per net ton, f.o.b. shipping point. Demand good.

New Caledonian, 52-54 per cent Cr_2O_3, $24; nominal.

[1]**Galena Radio Crystals**—Best quality (50 per cent of sized fragments good) 50c. per lb. in 500-lb. lots, f.o.b. Philadelphia.

Iron Ore—Lake Superior ores, per long ton, lower Lake ports:

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range bessemer, 51½ per cent, $4.55.

High-phosphorus foundry, over 0.18 per cent P, $4.15.

Stocks at Lake ports greatly reduced and higher prices expected next season.

Eastern ores, cents per unit delivered at furnaces: Foundry and basic, 53 to 63 per cent, 9@10c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

Swedish and Norwegian, low-phosphorus, 68 per cent, 11@11½c.

Spanish and Algerian, low-phosphorus, 52@54 per cent, 9@10c.

Spanish foundry or basic, 50@54 per cent, 8½@9c.

Swedish foundry or basic, 66@68 per cent, 9@10c.

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports: Brazilian, 42@44c., nominal; Indian, 44c., nominal; Caucasian (unwashed), 40c.; Caucasian (washed), 43c.; market has been dull.

Chemical grades[1], powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80 per ton in carloads.

Molybdenum Ore—55@65c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, f.o.b. mines.

[1]**Pyrite Radio Crystals**—50c.@$1 per lb.

Tantalum Ore—Foreign, 75c. per lb. of Ta_2O_5 contained, c.i.f. New York.

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $11.50@$12.50; Western scheelite, $12.50@$13.50. Domestic demand very light, and prices largely nominal but firmly maintained. European demand good.

Vanadium Ore—Minimum 18 per cent V_2O_5, $1@$1.25 per lb. V_2O_5. Nominal.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]**Amblygonite**—8@9 per cent lithium oxide, $50@$60 per ton, f.o.b. mines.

Andalusite—Sorted, $45@$50 per ton, f.o.b. *South Dakota* mines. Sales mostly for experimental lots.

Asbestos—F.o.b. *Quebec* mines, tax and bags included, per ton:

Crude No. 1, $500@$525; crude No. 2, $300@$325; spinning fibers, $175@$190; magnesia and compressed sheet fibers, $125@$150; shingle stock, $70; paper stock, $40@$45; cement stock, $25; short fibers, $10@$17.50; floats, $15.

The market is good and prices are higher and firm. Merger corporation known as Asbestos Corporation, Ltd., includes nine producers and three manufacturers. A scarcity of low-grade material is reported.

No. 1 Rhodesian crude, $325; No. 2, $250 per ton, c.i.f. New York.

Barytes—F.o.b. mines, per ton, bags extra:

South Carolina: Crude, $7@$8 per gross ton; ground, off color, $14@$17 per short ton.

North Carolina: White bleached, $22 per short ton; white natural, $20.

Georgia: Barytes ore, washed, $7.50. Good demand at current quotation.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, $8@$8.50, f.o.b. mines.

Canada: 94@96 per cent $BaSO_4$, $9 per net ton, f.o.b. mine.

Bauxite — American, f.o.b. shipping point per gross ton: Crushed and dried, $5.50@$8.50; pulverized and dried, $14; calcined, crushed, $17@$20.

Foreign, per metric ton, c.i.f.: Dalmatian, low SiO_2, $5@$6.50; Istrian, $5.50@$7; French, red, $6@$7.50.

Borax—Carload lots, in bags, per lb.: crystals, 5c.; granulated or powdered, 4¾c.; f.o.b. plant, *Illinois*.

[1]**Celestite**—90 per cent $SrSO_4$, finely powdered, $30 per ton in carload lots.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Chalk—Crude, in bulk, per ton c.i.f. New York, $4.75@$5.

China Clay (Kaolin)—F.o.b. *Virginia* mines, per ton: crude, lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$20; ground, $7@$10.

Georgia, washed lump, $8.65; *Florida*, washed lump, $13.50.

1A grades, domestic, $16@$17, f.o.b. *Delaware* plants. Market slower.

Imported English, f.o.b. American ports: Lump, $11.50@$21; powdered, $45@$50. Demand good.

Diatomaceous Earth—Per short ton, f.o.b. plant, *California:*

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $30; natural aggregate, ¼ in., $20; air-floated powder, $40. "Calatom" (mill run), $20; market quiet on account of slack season in concrete pouring.

Emery — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½@4c. Market good.

Feldspar — F.o.b. mine or grinding plant:

North Carolina: No. 1 pottery grade, $6@$6.50 per long ton, depending upon quality. Market good.

New Hampshire: No. 1, not over 10 per cent SiO_2, $8.50 per short ton; pottery grade, $7.50. Ground, $17. Market fair.

New York: Per ton, f.o.b. cars, No. 1 crude, $8. Market good.

Maine: No. 1, ground, $19 per ton. Good demand.

Tennessee: No. 1 pottery, $16@$18 per ton for 140 and 200 mesh respectively. No. 1 enamel, 140 mesh, $14; 200 mesh, $16. Competition keen with some cutting of prices to get business, but demand good.

Maryland: 140 mesh, $18@$22; 120 mesh, $16; 60 to 100 mesh, $12@$15.

Canada, f.o.b. mine: High potash, $9, per ton, f.o.b. Quebec; crude, No. 1, over 12½ per cent potash, less than 5 per cent free SiO_2, $7.75@$8.50; crude, No. 2, 20 to 25 per cent free SiO_2, $6.25@$6.50.

Fluorspar—F.o.b. *Kentucky* and *Illinois* mines, per short ton:

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $17.50. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50. Acid ground packed in bags, $40@$45. Prices firm. Demand small. Stocks at mines and consuming points reduced.

Canada: 84@86 per cent CaF_2, less than 5 per cent silica, $16.

New Mexico: 85-5 gravel, $15.75; 80-6 gravel, $15 f.o.b. mines. Ground, 96 per cent through 100 mesh, $35. Market stronger.

Fuller's Earth—Per ton, f.o.b. *Midway, Fla.:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $15; 100 mesh "up," $8; 200 mesh "up," $15. Market somewhat stronger.

Powdered, imported, duty paid, $23@$25 per ton.

Garnet—Per ton f.o.b. mines: Domestic, $85; *Canadian*, $70@$80.

is available for February shipment. Scattering sales for early delivery have realized 9.125c. St. Louis, but, on the other hand, several good-sized transactions for March delivery have been closed at 9.075c. The volume of business has not been particularly large either in St. Louis or in New York. Most of the inquiries are for February, buyers seeming to be hesitant about committing themselves for forward purchases. The American Smelting & Refining Co. continues its official contract price in New York at 9.25c. which is also the prevailing quotation for other producers, although at least one good-sized sale was made at 9.225c. Specifications on contract for February are somewhat lower than they have been in the last three months. London has declined in the last two days, and this has had an easing effect on the New York market. The disparity between the European and American markets continues to be wide, so that foreign ore lead is advantageously brought to this country. So far as consumption is concerned, the slowness seems to be among the corroders rather than other classes of users.

Tin Prices Better

The tin market both here and abroad has improved during the week. An element in the strength is the issuance of the report showing American deliveries of 7,340 long tons in January making a reduction in New York stocks to 254 long tons. In all, the visible supply is only about 16,700 long tons, virtually represented by the metal afloat. Buying for some time has been of the hand-to-mouth type, with little purchased ahead. With consumption apparently well maintained on this side, the position seems strong. New supplies from the Straits in January were 1,600 long tons more than the December figures, but this was offset by smaller shipments of Banka metal. The backwardation in London has been close to £5 per ton, which reflects the shortage of spot metal in that market.

Zinc Slightly Above 8c.

The recent reaction in zinc prices, which caused a dip under the 8c. level last Wednesday, came to an end on Friday, with the upturn in the London market. Sales have been fairly good at 8c. and slightly above, though galvanizers have been buying in rather small lots, and for early delivery. As high as 8.10c. was done for prompt zinc yesterday, but today the market both in St. Louis and London is slightly easier, and holds at about 8.075c. for prompt, and 8.00c. for March and April. High-grade zinc has also suffered somewhat in demand recently, and one seller has seen fit to reduce prices to an even 10c. to tempt buyers. Brass makers have not been active in the zinc market lately.

Silver Steady

Silver prices advanced slightly on Feb. 2, owing to purchases by China, but on a reversal of her position the following day quotations in London declined, although the reaction in New York was not appreciable. India continues to show some interest at rates below the current market, but generally speaking there is little interest in silver at the present time.

Mexican Dollars: Jan. 28th, 51¼c.; 29th, 51⅛c.; 30th and Feb. 1st, 51¼c.; 2d, 51⅛c.; 3d, 51⅛c.

Foreign Exchanges Quiet

Foreign exchanges showed no important fluctuations during the week, though francs and lire have been fractionally stronger. Sterling made a close approach to parity for the first time since 1914, and is likely to reach it soon. Closing cable quotations on Tuesday, Feb. 2, were as follows: francs, 3.755c.; lire, 4.015c.; and marks, 23.81c. Canadian dollars, 3/32 per cent

Zinc Blende and Lead Ore Both Lower

Joplin, Mo., Jan. 30, 1926

Zinc Blende	Per Ton
High	$60.00
Premium blende, basis 60 per cent zinc	$54.00@$55.00
Prime Western, basis 60 per cent zinc	$53.00
Fines and slimes, 60 per cent zinc	$52.00@$49.00
Average settling price, all blende	$54.77
Galena	
High	$123.70
Basis 80 per cent lead	$120.00
Average settling price, all galena	$121.46

Shipments for the week: Blende, 21,744; lead, 2,883 tons. Value, all ores the week, $1,541,210.

Shipments for the month: Blende, 75,503; lead, 10,961 tons. Value, all ores the month, $5,470,230.

Zinc concentrate prices were further reduced $1 per ton on all grades this week. Buyers took all offerings, a total of 16,610 tons being marketed. Shipments of 21,744 tons indicate that stocks in bins were lowered, as production was only 18,430 tons. More mills are in operation than of any previous record, the total being 178, with 37 of these operating double shift.

Buyers and sellers alike were surprised at the drop in lead prices, the impression having gained currency that this metal was due to climb steadily. Sellers did not offer galena as freely on the market this week, as in the last few weeks.

Platteville, Wis., Feb. 3, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$56.50
Lead Ore	
Lead, basis 80 per cent lead	$122.50

Shipments for the week: Blende, 773 ton; lead, none. Shipments for the year: Blende, 3,409; lead, 100 tons. Shipments for the week to separating plants, 1,708 tons blende.

Steel and Pig Iron Quiet—Coke Steady

Pittsburgh, Feb. 2, 1926

January appeared to the steel trade as a disappointing month in that buying did not return to the pre-holiday rate, showing indeed only a little increase. Shipments materially exceeded new orders and specifications. Total obligations of mills increased still more, as in the first month of a quarter there is naturally practically no contracting. Shipments, however, held up well, mill operations being substantially as heavy in January as in the two preceding months, making heavy production for the three months, and willingness to take shipments is positive proof of heavy operations by steel buyers.

Steel prices are unchanged all along the line, and no softening or stiffening tendency is observable in any individual product.

Prospects are for slightly lighter production in February and March, but still heavy enough, probably, to make a new record for six months' output.

Freight-car buying and fabricated structural steel lettings were fair in January. Automobile production was unexpectedly light, perhaps even below that of December.

Pig Iron.—The market remains quiet. Prices are easily held, despite light inquiry. Production has been less than expected. Several furnaces announced as likely to come in have not done so, and at least two have been banked to release coke for sale in the East. Bessemer, $21; basic, $20; foundry, $20.50, f.o.b. Valley furnaces.

Connellsville Coke. — Demand from the East has been for very prompt shipment; operators have been oversold, and thus prices have been held at levels that may yield sharply any moment. Run-of-oven coke, $9@$10; yard crushed, $11@$12, per net ton at ovens.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118 long ton. Domestic demand good. Fair business in Great Britain.

Antimony — Per pound, New York, duty paid: Chinese brands, spot, 22@22½c.; March arrival, 21½@22c. Cookson's "C" grade, spot, 23¾c. Market entirely nominal.

Chinese needle, lump, 15@16c. Standard powdered needle, 200 mesh, 19½@20c. White oxide, Chinese, 99 per cent Sb_2O_3, 19@19½c.

Bismuth—$3.30@$3.35 per lb. in ton lots. London, 12s. 6d.

Cadmium — 60c. per lb. London, 1s. 9d. for Australian metal.

Cobalt—Shot, 96@98 per cent, $2.50 per lb. Black oxide, 70 per cent, $2.20; gray oxide, 75 per cent, $2.35. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray. Market quieter.

[1]**Germanium Oxide**—25 to 50 gm. lots, $6 per gm.

Iridium—$340 per oz. for 98@99 per cent. Nominal. London, £80@£85 for 99.5 per cent.

[1]**Lithium**—95@96 per cent grade in 1 to 5 lb. lots, $65 per lb.

Magnesium — Ingot, 99.85 per cent, 90c. per lb. in ton lots. Market steady.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Spanish grades, $60, c.i.f. port of entry.

Gilsonite—Per ton, carload lots, f.o.b. mines *Colorado:*

Jet asphaltum, $36; selects, $33; seconds (ordinary grades), $25.50; peerless black, $32.90. Market steady.

Graphite—F.o.b. New York, per lb.:

Ceylon lump, 9¼@9¾c.; chip, 7½@8c. dust, 3@5½c. Madagascar flake, 8@10c. Market fair.

Flake, 12@20c. according to grade; fine ground crystalline, 5@10c.; amorphous ground graphite, 6@8c. Crude amorphous graphite, $15@$35 per ton according to grade.

Prices have risen about 50 per cent during past year. Decline expected in some quarters.

Greensand—Per ton, f.o.b. cars, *New Jersey:* screened and bagged, best grade in carload lots, $30.

Gypsum—Per ton f.o.b. mill, depending upon location: crushed, $2.75@$3; ground, $4@$6; agricultural, $6@$12; calcined, $8@$13.

[1]**Ilmenite**—Concentrates, 52 per cent TiO_2, 1½c. per lb., f.o.b. *Virginia* points. $60 per short ton, *Florida* mines.

Iron Oxide (See Ocher)—Standard Spanish red, 3@4c. per lb.; domestic earth, 2@4½c.

Kaolin—See China Clay.

[1]**Lepidolite**—$20@$30 per ton for ordinary grades. Nominal.

Limestone—F.o.b. shipping points, depending on location: crushed, ¾ in. and less, 90c.@$2; 3 in. and larger, 90c. @$1.80 per ton.

Agricultural, $1.50@$5 for pulverized; 75c.@$2 for crushed, depending upon source, purity, and fineness.

Magnesite—Per short ton, f.o.b. *California* mines: Grade "A," 80 per cent through 200 mesh, $40; dead burned, $35; crude, $14. Market fair.

Manjak—Barbados, in 10-ton lots, c.i.f. New York: grade "A," 6c. per lb.; grade "AA," fine, 8½c.

Mica—F.o.b. plant, per ton:

North Carolina: 20 mesh, roofing, $38; 100 mesh, white ground, $70. Market good.

New Hampshire: Mine run, $380, clean shop scrap, $25; mine scrap, $20. White, dry ground, 20 mesh, $35; 40 mesh, $45; 60 mesh, $60; 100 mesh, $75; 200 mesh, $85. Outlook good for 1926.

Madagascar, amber, dark, free from iron, per lb., f.o.b. *New York*, duty paid: special grade, $3@$3.25; No. A 1, $2.75; No. 1, $2.50; No. 2, $2.20; No. 3, $1.20; No. 4, 60@70c. No. 5, 42@45c. Grades depend on size of sheets.

[1]**Monazite**—Minimum 6 per cent ThO_2, $120 per ton.

Ocher—F.o.b. *Georgia* mines, per ton: $22.50@$25 in sacks; $25@$30 in barrels; washed and water floated, $25@$28; second grade, 99 per cent through 225 mesh, $19. Market good.

Phosphate—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $6.25; 75 per cent, $5.65; 74@75 per cent, $5.40; 70 per cent, $3.75; 68 per cent, $3.50. Market firm; prices up slightly for lower grades.

Florida, pebble, domestic: 76@77 per cent, $5.75; 75 per cent, $5; 74@75 per cent, $4.75; 70 per cent, $3; 76@78 per cent special, $6.25. Market dull; seasonal.

Tennessee, lump, ¾-in. screen, base 75 per cent, $6. Ground, 95 per cent through 200 mesh, base 65 per cent, $7.

Potash—	Bags	Bulk
Muriate of potash 80@85 per cent, basis 80 per cent	$34.90	$33.65
Sulphate of potash 90@95 per cent, basis 90 per cent	45.85	44.60
Sulphate of potash-magnesia 48@53 per cent, basis 48 per cent	26.35	25.10
Manure salt 30 per cent	20.00	18.00
Manure salt 20 per cent	13.35	11.35
Kainit 14@16 per cent	10.50	8.50
Kainit 12.4 per cent	10.00	8.00

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

Discounts: 5 per cent on minimum of 50 tons K_2O; 6 per cent on 100 tons; 7 per cent on 300 tons; 10 per cent on 500 tons. Prices guaranteed against sellers' decline until April 30, 1926. Strong undertone to market.

Pumice Stone—In barrels, per lb., powdered, 3@5c.; selected lumps, 6@ 8c.; lumps in bags, 4@6c.

Pyrites—Tharsis, per long ton unit of sulphur, c.i.f. U. S. ports: furnace size, 13½c. Cinder from ore to remain property of buyers. Market stronger, with good inquiry.

[1]**Quartz Rock Crystals**—Colorless, clear and flawed, pieces ¼ to ½ lb. in weight, 40c. per lb. in ton lots. For optical purposes, double above prices.

Rutile—*Virginia*, per lb.; granular, 94@96 per cent TiO_2, 12@15c.; pulverized, 100 mesh, 94@96 per cent, 17@ 30c.

Florida 93 per cent TiO_2, $200 per ton.

Silica—Water ground and floated, per ton in bags f.o.b. *Illinois:* 450 mesh, $31; 350 mesh, $26; 250 mesh, $22.

Glass sand, $1@$5 per ton; brick and molding sand, 30c.@$2; blast sand, $2.50@$4.50.

[1]**Spodumene**—$20@$30 per ton, depending upon lithium content. Nominal.

Sulphur—$16 per ton for domestic, f.o.b. *Texas* mines; $20 for export, f.a.s. *New York*. Good shipment against contracts. Open prices $1 higher.

Talc—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 200 mesh, extra white, $11; 180 mesh, medium white, $10; packed in 50-lb. paper bags. Demand fair but prices steady.

New York: Double air-floated, 100 mesh, $11.25; 200 mesh, $13.75; 325 mesh, $14.75. Demand fair.

Georgia: Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9. Market fair.

New Jersey: Soapstone, ground, $10@$12; market fair.

Tripoli—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri*: Once ground through 40 mesh: rose and cream colored, $16. Double ground through 110 mesh: rose and cream, $17. Air-floated through 200 mesh: rose and cream, $25; mill run, $15. Active business at lower prices.

[1]**Zircon**—Freight allowed east of Mississippi River: 95 per cent, 3c. per lb., f.o.b. mines, in carload lots.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Mineral Products

Arsenious Oxide (white arsenic)—3@3½c. per lb. Largely nominal. London £14@£15 per long ton.

Copper Sulphate—Large crystals, 4.40@4.70c. per lb.; small, 0.1c. less.

Sodium Nitrate—Spot, crude $2.71@ $2.74 per 100 lb., ex vessel Atlantic ports.

Sodium Sulphate—$1.10@$1.20 per 100 lb., f.o.b. works, for Glauber's salt.

Zinc Oxide—Per lb. in bags: Lead-free, 7½c.; 35 per cent leaded grades, 8c.; French in car lots, 10½c.

Ferro-Alloys

[1]**Ferrocerium**—$7 per lb.

Ferrochrome—1@2 per cent carbon, 23@25c. per lb. of contained chromium; 4 to 6 per cent carbon, 11½c. per lb; 0.1 per cent, 35c. per pound.

Ferromanganese—Domestic and foreign, 78@82 per cent, $115 per gross ton. Spiegeleisen, 19@21 per cent, $33@$34 f.o.b. furnace; 16@19 per cent, $32.

Ferrophosphorus—Electrolytic, 18 per cent P, $91 per ton; 24 per cent, $122.50; f.o.b. Ala. and Tenn.

Ferrosilicon—14 to 16 per cent, $42 @$47 per gross ton, f.o.b. works; 50 per cent, $85 delivered in carload lots; 75 per cent, $145. Market active.

Ferrotitanium—For 15 to 18 per cent material, $200 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten—$1.14@$1.17 per lb. of contained W, f.o.b. works, according to grade.

[1]**Ferro-uranium**—30 to 40 per cent U, $4.50 per lb. of U contained, f.o.b. works in 500-lb. lots.

Ferrovanadium—Per lb. of V contained, f.o.b. works, $3.40@$3.90.

Metal Products

Rolled Copper—Sheets, 22½c.; wire, 16c.

Lead Sheets—Rolled, 13c.; clipped, 13¼c.

Nickel Silver—29½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, 19¾c. per lb.; rods, 16¾c. per lb.

Zinc Sheets—12c. per lb., f.o.b. works.

Refractories

Chrome Brick—$45@$48 per net ton, f.o.b. shipping point.

Firebrick—First quality, $43@$46 per M., Ohio, Kentucky, Central Pennsylvania; second quality, $35@$40.

Magnesite Brick—9-in. straights, $65 per net ton, f.o.b. works.

Silica Brick—$40 per M. Pennsylvania and Ohio; $48@$52 Alabama.

[1]**Zirkite**—Powdered, 80 per cent ZrO_2, 2½c. per lb. Brick, straights, 80c.@$1 each.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1925	1926	1925	1926	1925	1926
January	68.447	67.795	32.197	31.308	477.702	485.295
February	68.472	.....	32.245	.....	476.886	.....
March	67.808	.....	31.935	.....	477.279	.....
April	66.899	.....	31.372	.....	479.034	.....
May	67.580	.....	31.276	.....	484.960	.....
June	69.106	.....	31.863	.....	485.553	.....
July	69.442	.....	31.954	.....	485.514	.....
August	70.240	.....	32.268	.....	485.264	.....
September	71.570	.....	32.983	.....	484.270	.....
October	71.106	.....	32.972	.....	483.909	.....
November	69.223	.....	32.155	.....	484.201	.....
December	68.889	.....	31.835	.....	484.538	.....
Year	69.065	.....	32.088	.....	482.426	.....

New York quotations cents per ounce troy, 999 fine, foreign silver. London pence per ounce, sterling silver, 925 fine.

Copper

	New York	London			
	Electrolytic	Standard		Electrolytic	
	1925	1926	1925	1926	1925	1926
January	14.709	13.822	66.065	59.013	70.607	65.325
February	14.463	.....	64.714	.....	69.525	.....
March	14.004	.....	62.892	.....	67.739	.....
April	13.252	.....	60.575	.....	64.194	.....
May	13.347	.....	60.131	.....	63.560	.....
June	13.399	.....	59.899	.....	63.369	.....
July	13.946	.....	61.467	.....	65.750	.....
August	14.490	.....	61.613	.....	68.169	.....
September	14.376	.....	61.886	.....	67.693	.....
October	14.300	.....	61.977	.....	67.523	.....
November	14.353	.....	61.280	.....	67.893	.....
December	13.866	.....	59.540	.....	65.625	.....
Year	14.042	.....	61.920	.....	66.804	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London		
	1925	1926	1925	1926	1925	1926	1926 3 M
January	10.169	9.255	9.953	9.102	41.443	34.778	34.584
February	9.428	.....	9.126	.....	37.944	.....	.....
March	8.914	.....	8.578	.....	36.804	.....	.....
April	8.005	.....	7.662	.....	32.791	.....	.....
May	7.985	.....	7.780	.....	32.283	.....	.....
June	8.321	.....	8.024	.....	33.479	.....	.....
July	8.151	.....	8.054	.....	34.698	.....	.....
August	9.192	.....	9.284	.....	38.188	.....	.....
September	9.508	.....	9.303	.....	38.884	.....	.....
October	9.513	.....	9.299	.....	39.017	.....	.....
November	9.739	.....	9.578	.....	36.872	.....	.....
December	9.310	.....	9.157	.....	34.739	.....	.....
Year	9.020	.....	8.817	.....	36.429	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York				London	
	99%		Straits			
	1925	1926	1925	1926	1925	1926
January	57.692	61.415	58.250	62.275	265.560	282.038
February	56.517	.....	57.068	.....	262.181	.....
March	53.038	.....	53.733	.....	245.682	.....
April	51.380	.....	52.135	.....	237.006	.....
May	53.675	.....	54.620	.....	245.476	.....
June	54.885	.....	55.957	.....	252.476	.....
July	56.683	.....	58.014	.....	258.435	.....
August	56.649	.....	58.190	.....	258.538	.....
September	56.405	.....	58.247	.....	259.182	.....
October	60.462	.....	62.274	.....	277.722	.....
November	62.136	.....	63.304	.....	284.506	.....
December	61.952	.....	62.928	.....	284.920	.....
Year	56.790	.....	57.893	.....	260.974	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London		
			1925		1926
	1925	1926	Spot	1926	3 M
January	7.738	8.304	37.917	38.059	37.363
February	7.480	.....	36.528	.....	.....
March	7.319	.....	35.741	.....	.....
April	6.985	.....	34.644	.....	.....
May	6.951	.....	34.223	.....	.....
June	6.990	.....	34.149	.....	.....
July	7.206	.....	34.894	.....	.....
August	7.576	.....	36.691	.....	.....
September	7.753	.....	37.435	.....	.....
October	8.282	.....	39.884	.....	.....
November	8.614	.....	39.039	.....	.....
December	8.565	.....	38.327	.....	.....
Year	7.622	.....	36.624	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York
	1925	1926	1925	1926	1925	1926	1926
January	17.428	23.490	81.596	87.960	117.000	118.20	113.20
February	19.795	.....	79.386	.....	117.000	.....	.....
March	15.553	.....	80.481	.....	117.000	.....	.....
April	12.553	.....	82.327	.....	118.269	.....	.....
May	15.770	.....	81.360	.....	119.850	.....	.....
June	16.500	.....	83.154	.....	120.000	.....	.....
July	17.779	.....	83.077	.....	120.000	.....	.....
August	17.683	.....	82.317	.....	120.000	.....	.....
September	17.143	.....	81.730	.....	120.000	.....	.....
October	18.029	.....	83.856	.....	120.000	.....	.....
November	20.000	.....	88.250	.....	120.000	.....	.....
December	21.692	.....	90.000	.....	120.000	.....	.....
Year	17.494	.....	83.128	.....	119.093	.....	.....

(a) Antimony quotations in cents per pound for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1925	1926	1925	1926	1925	1926
January	24.66	22.76	23.76	21.76	23.76	22.26
February	24.50	.....	23.26	.....	23.76	.....
March	24.06	.....	23.06	.....	22.91	.....
April	22.89	.....	21.76	.....	22.26	.....
May	21.57	.....	20.26	.....	21.16	.....
June	20.76	.....	19.76	.....	20.11	.....
July	20.76	.....	19.76	.....	20.26	.....
August	20.76	.....	19.76	.....	20.26	.....
September	21.04	.....	20.03	.....	20.50	.....
October	21.50	.....	20.37	.....	20.83	.....
November	22.64	.....	21.58	.....	22.08	.....
December	22.76	.....	21.76	.....	22.26	.....
Year	22.33	.....	21.26	.....	21.68	.....

In dollars per long ton.

Monthly Crude Copper Output in Short Tons

Domestic

	1925					
	July	Aug.	Sept.	Oct.	Nov.	Dec.
Alaska shipments	3,643	67	5,496	3,140	4,677	2,880
Calumet & Arizona	1,876	1,970	1,840	2,117	2,070	1,682
Miami	1,861	2,350	2,088	2,052	2,090	2,112
New Cornelia	2,834	2,460	2,806	2,734	2,150	3,604
Old Dominion	1,120	1,030	1,371	1,097	958	1,217
Phelps Dodge	6,873	6,600	6,748	6,636	6,500	6,957
United Verde Extension	1,931	1,928	1,865	1,797	1,632	1,874
Tennessee Copper	549	610	585	596	573	604
Imports: Ore and concentrates, matte	5,261	6,485	4,34u	5,970	6,597	5,424
Imports of black and blister, unrefined	16,796	23,309	16,815	14,990	14,296	16,402
Imports of refined and old	2,461	4,348	5,440	4,678	6,972	7,406

Foreign

Boleo, Mexico	791	832	858	854	798	773
Furukawa, Japan	1,615	1,409	1,575	1,613	1,349	.....
Granby Cons., Canada	1,620	1,669	1,495	1,738	1,396	1,927
Katanga, Africa	9,045	10,165	8,284	8,703	8,207	6,703
Mount Morgan, Aust	415	272	....	....	....	.....
Mount Lyell, Aust	....	....	2,076(a)	....	....	.....
Phelps Dodge, Mexican	1,982	2,118	1,963	1,822	2,224	2,154
Sumitomo, Japan	1,570	1,691	1,011	....	....	.....

(a) Three months.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1923		1924		1925	
	Monthly Production	Daily Rate	Monthly Production	Daily Rate	Monthly Production	Daily Rate
January	56,134	1,811	66,631	2,149	74,789	2,412
February	51,368	1,834	65,681	2,2o5	68,967	2,463
March	60,781	1,961	65,181	2,103	74,901	2,416
April	59,078	1,969	66,073	2,202	70,667	2,356
May	62,718	2,023	65,608	2,116	70,574	2,276
June	62,740	2,091	63,933	2,131	69,894	2,330
July	63,071	2,034	64,787	2,090	68,5u7	2,210
August	65,865	2,125	66,756	2,153	68,090	2,196
September	62,255	2,075	63,800	2,127	67,720	2,272
October	66,035	2,130	68,989	2,225	70,819	2,284
November	63,885	2,129	68,291	2,276	67,400	2,247
December	64,832	2,091	67,647	2,182	69,178	2,231
Total	738,763	.....	793,377	.....	841,506	.....
Monthly average	61,564	.....	66,1i5	.....	70,126	.....
Average of daily rate	.....	2,024	.....	2,168	.....	2,305

Foreign Demand for Copper Disappointing; Domestic Sales Large but Irregular

By Edward Hodges Robie
Assistant Editor

NOW THAT complete data on the copper industry during 1925 are available, it is very evident that producers can thank the domestic users of the metal, rather than foreign consumers, for such strength as the copper market possessed in the closing months of the year. For some years, an increasing foreign demand has been held to be a requisite for prosperity in the copper industry. Export demand was excellent in the first half of 1925, as is indicated by the graphs shown in Fig. 1, Germany being a particularly important buyer, but in recent months the shipments of copper to Europe have recorded a marked decline,

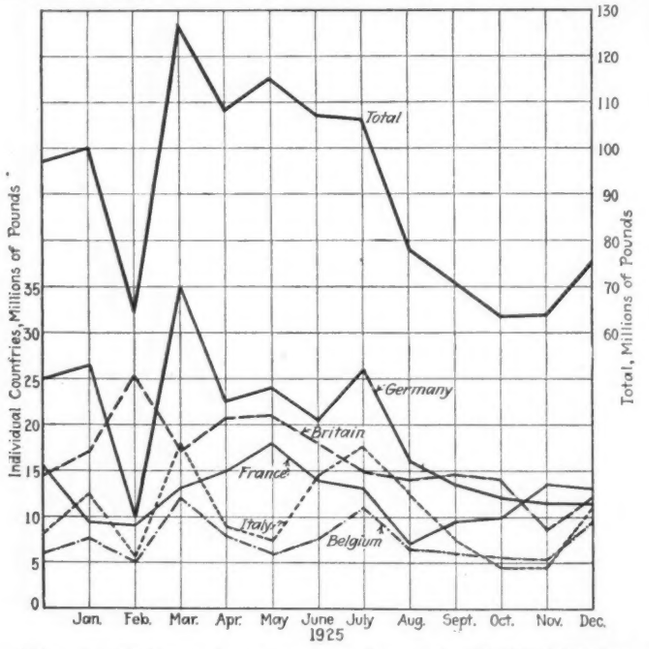


Fig. 1—Shipments of copper from the United States

though a little encouragement can be found in the modest increase in December. France alone, of the important copper-consuming countries of Europe, has shown a well-sustained demand for the metal. It is interesting to observe that in December there was comparatively little difference in the volume of shipments to each of the five countries—Germany, the United Kingdom, France, Belgium, and Italy. Any improvement in the copper market, or even stability at present levels, would seem to require increased European purchases over those of the last few months, for domestic business cannot be expected to rise much above the present extraordinary level, and stocks have recently shown a tendency to increase.

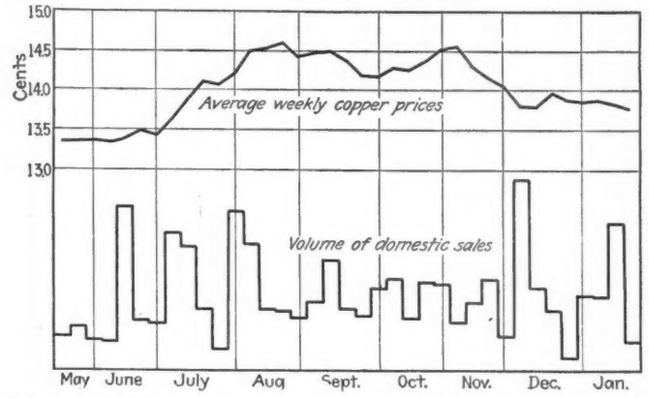


Fig. 2—Comparison of tonnage of domestic sales and prices, f.o.b. refinery, May, 1925, to January, 1926

Domestic shipments, of course, have been enormous, rising from 191,771 tons in the first quarter of 1925 to 194,177 tons in the second quarter, to 214,618 in the third, and to 230,605 tons in the fourth quarter. No let-up in the industrial prosperity of the United States is foreseen for the first six months of 1926; for the last half of the year, economists have little data on which to base a prediction, but most of them feel that it is more conservative to suggest a gradual decline in the consumption of goods. If this occurs, it is to be hoped that Europe will have regained its lost ground in industrial activity.

The decline in foreign demand and the recent introduction of a bill at Washington calling for a 6c. import duty on copper again bring up the relation between imports and exports. The table published a year ago in *Mining Journal-Press* is therefore brought up to date:

United States Imports and Exports of Copper

In Tons of 2,000 lb.

1923	Imports	Exports	Exportable Surplus
First quarter	70,842	99,425	28,583
Second quarter	98,999	97,250	—1,749
Third quarter	97,415	105,050	7,635
Fourth quarter	88,778	119,250	30,472
Entire year	356,034	420,975	64,941
1924			
First quarter	103,080	135,650	32,570
Second quarter	99,364	154,305	54,941
Third quarter	88,443	138,930	50,487
Fourth quarter	97,598	159,915	62,317
Entire year	388,485	588,800	200,315
1925			
First quarter	70,549	163,490	92,941
Second quarter	90,266	179,250	88,984
Third quarter	86,698	138,430	51,732
Fourth quarter	83,889	108,060	24,171
Entire year	331,402	589,230	257,828

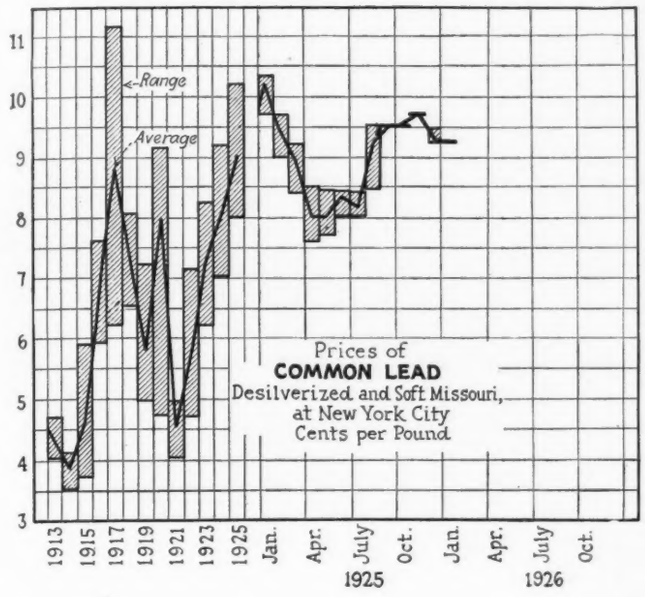
The figures are compiled from official reports of the U. S. Department of Commerce, and include all copper-bearing material reported, brass being considered as containing 80 per cent copper.

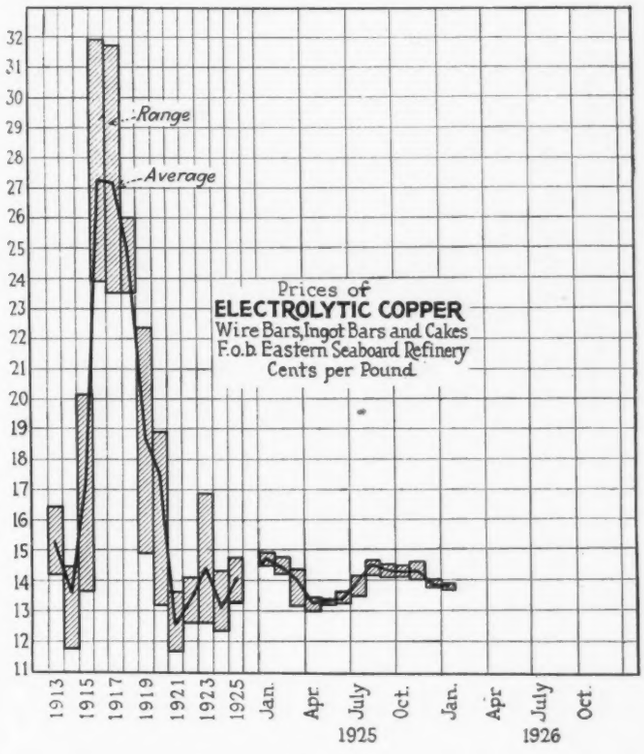
Though the exportable surplus of the United States was greater in 1925 than in 1924, nevertheless a pronounced falling off has occurred in the last two quarters. The surplus is still appreciable, however, and as long as it exists an import duty on copper should have the same effect on copper prices as has the import duty on zinc—which is none at all. It may be noted that imports have shown no indication to increase; in fact they were less in 1925 than in either 1924 or 1923.

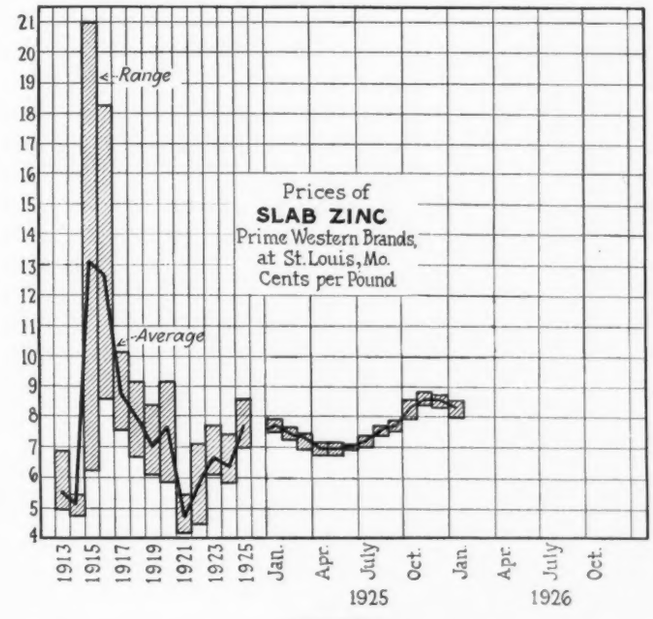
Copper continues to be bought in waves, or buying movements, as Fig. 2 indicates, the volume of sales there shown representing the approximate total of domestic business reported to *Mining Journal-Press* each week. During June, July, and August of last year three such buying movements occurred in the weeks ended June 17, July 8-15, and Aug. 5-12. This buying was on a rising market, the slight declines of the weeks of June 10, July 1, and July 29 evidently stimulating purchases. During September, October, and November buying was reasonably steady, as was the price until Nov. 5, when 14.625c. was reached. Since then has followed a rather sharp decline, owing to an irregular domestic demand and poor foreign sales. This decline was temporarily arrested by the enormous sales of the week ended Dec. 9, but has since continued, not even being interrupted by the good business in the week of Jan. 20.

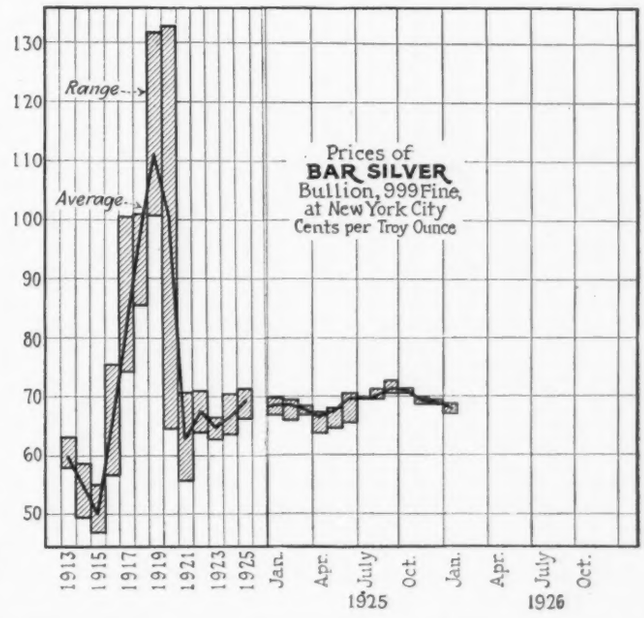
Good domestic buying has apparently done little in recent weeks to improve copper prices, and more foreign sales are evidently necessary to counteract the downward tendency that the copper market has exhibited in the last three months. If, as some believe, Secretary Hoover's gestures have had such an effect on rubber prices, possibly a word or two from Washington might help copper! There is more ground for hope, however, in a careful cultivation and handling of the European market.

Metal Price Curves

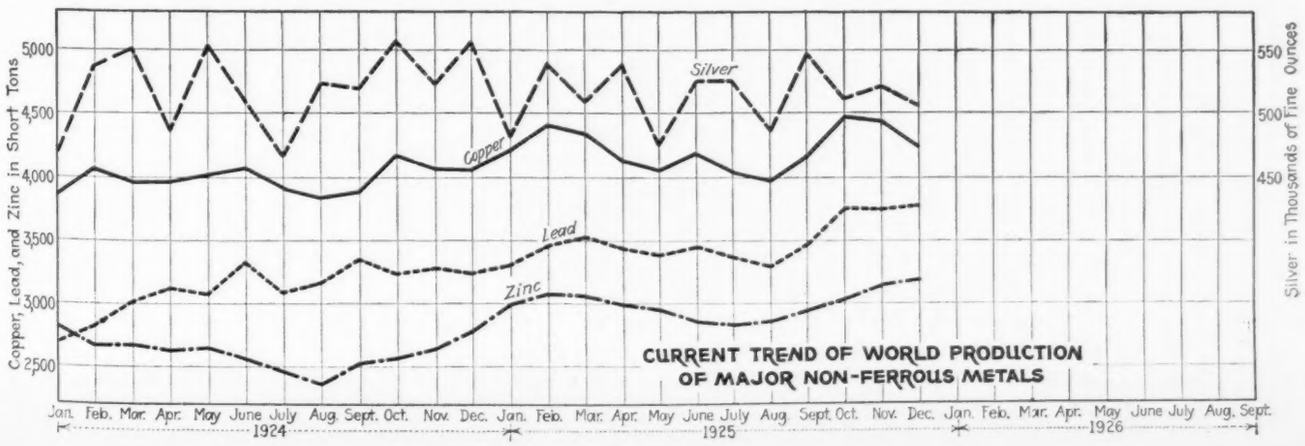



Range
Average
Prices of
ELECTROLYTIC COPPER
Wire Bars, Ingot Bars and Cakes
F.o.b. Eastern Seaboard Refinery
Cents per Pound
1913 1915 1917 1919 1921 1923 1925 Jan. Apr. July Oct. Jan. Apr. July Oct.
1925 1926





THE curves below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output, according to latest estimates of the American Bureau of Metal Statistics. The figures represent countries that produced in 1923 and 1924 about 97 per cent of the world's output of copper; 78.5 per cent of the lead; 87.5 per cent of the zinc; and 81 per cent of the silver.


Silver
Copper
Lead
Zinc
Copper, Lead, and Zinc in Short Tons
Silver in Thousands of Fine Ounces
CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept.
1924 1925 1926

Mining Stocks—Week Ended January 30, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	48⅛	46⅛	48⅛	Ja.16,Fe.23,Q	0.75
Arcadian Consol.	Boston	*70	*45	*50		
Ariz. Com'l	Boston	12	11⅛	11⅛	Jy.21, Jy. 31 SA	0.50
Calaveras	N. Y. Curb	4	3⅛	3⅛		
Calumet & Arizona	New York	62½	59⅛	62¼	De.4, De.21 QX	1.50
Calumet & Hecla	Boston	15	14½	15	Nov.30,De.15 Q	0.50
Cerro de Pasco	New York	66	60	64⅞	Ja. 14, Fe. 1, Q	1.00
Chile Copper	New York	34⅛	33	34	Ma.3,Ma.29,Q	0.62½
Chino	New York	17	16½	17	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	1⅞	1⅝	1⅞		
Copper Range	Boston	18⅛	18⅛	18⅛	May, 1925	1.00
Crystal Copper	Boston Curb	*50	*45	*46		
East Butte	Boston	3⅛	3⅛	3⅛	Dec., 1919	0.50
First National	Boston Curb	*20	*18	*18	Feb., 1919	0.15
Franklin	Boston	1	*85	*85		
Granby Consol.	New York	22⅝	19½	22⅝	May, 1919	1.25
Greene-Cananea	New York	12⅛	10⅛	11⅛	Nov., 1920	0.50
Hancock	Boston			*80		
HoweSound,new,r.t.c.	New York	30½	29½	30½	Ja. 5, Ja. 15 Q	0.50
Inspiration Consl.	New York	25⅛	24⅛	24⅞	De.17, Ja.4, Q	0.50
Iron Cap	Boston Curb	2⅛	2 1/16	2⅛	May, 1923	0.15
Isle Royale	Boston	12⅛	11	11⅛	No.30, De.5	1.00
Jerome Verde Dev.	N. Y. Curb	1⅛	1 1/16	1⅛		
Kennecott	New York	55⅛	54⅛	55⅛	Ma.5,Ap.1 Q	1.00
Lake Copper	Boston	1	1	1	June, 1925	0.50
Magma Copper	New York	43⅛	41⅛	43⅛	De.31, Ja.15,	0.75
Mason Valley	N. Y. Curb	2	1⅞	2		
Mass Consolidated	Boston	*50	*50	*50	Nov., 1917	1.00
Miami Copper	New York	12⅛	11⅛	12	Feb.1, Feb.15 Q	0.25
Mohawk	Boston	35	33	33⅞	Jan. 30, Mar. 1	1.00
Mother Lode Coa.	New York	7⅛	6⅞	7⅛	De. 11, De. 31	0.37½
Nevada Consol.	New York	13⅛	12⅛	13⅛	De. 18, De.31 Q	0.25
New Cornelia	Boston	20⅛	19⅛	20	Fe.5, Fe.23 Q	0.30
North Butte	Boston	3⅛	2⅞	3	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*68	*65	*65	No. 14, De. 2	0.05
Old Dominion	Boston	18⅛	17⅛	18⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†121	†117		De.21, Ja.2 Q	1.00
Quincy	Boston	20	18⅛	19⅛	Mar., 1920	1.00
Ray Consolidated	New York	12	11⅛	11⅞	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			14		
St. Mary's Min. Ld.	Boston	35⅛	33⅛	35	May, 1925	3.00
Seneca Copper	New York	8⅛	7⅞	8⅛		
Shannon	Boston	*70	*55	*70	Nov., 1917	0.25
Shattuck Arizona	New York	66⅛	62	65⅛	Jan., 1920	0.25
Superior & Boston	Boston	1	*65	1		
Tenn. C. & C.	New York	14⅛	13⅞	14⅜	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	28⅞	28	28⅛	Ja.5, Fe.1, Q	0.75
Utah Copper	New York	97⅛	96	97⅛	De.18, De.31, Q	1.25
Utah Metal & T.	Boston	*99	*80	*92	Dec., 1917	0.30
Victoria	Boston	*45	*45	*45		
Walker Mining	Salt Lake	1.60	1.20	1.50		
NICKEL-COPPER						
Internat. Nickel	New York	43	41⅞	42⅞	De.17,De.31,Q	0.50
Internat. Nickel, pfd.	New York	103⅛	101⅛	101⅛	Ja.25, Fe.1, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*34⅜	*32	*34⅜	Ja. 1, Ja. 10 M	0.01
National Lead	New York	168	164	167	De.11, De.31 Q	2.00
National Lead pfd.	New York	116	116	116	Aug.21, Se.15	1.75
St. Joseph Lead	New York	44⅛	43⅜	44⅛	De.10,De.20 QX	1.50
ZINC						
Am. Z. L. & S.	New York	9	8¾	9	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	40⅛	39	40⅛	Nov., 1920	1.50
Butte C. & Z.	New York	5⅜	5⅛	5⅛	De.10, De.24	0.50
Butte & Superior	New York	15	13⅛	15	De.15, De.31 Q	0.50
Callahan Zn-Ld	New York	2⅛	2	2⅛	Dec., 1920	0.50
Eagle Picher	Cincinnati	34⅛	33⅜	33⅜	De.1, De.31	0.40
Eagle Picher, pfd.	Cincinnati			110	Ja. 1, Ja. 31	1.50
New Jersey Zn.	N. Y. Curb			208	No.20,Dec.10 X	2.00
United Zinc	N. Y. Curb			*70		
Yellow Pine	Los Angeles	*36½	*25	*25	Se.10 Se.21 Q	0.04
GOLD						
Alaska Juneau	New York	1⅜	1⅜	1⅜		
Argonaut	Toronto	*20½	*10½	*20½		
Barry-Hollinger	Toronto	*29½	*25½	*29½		
Carson Hill	Boston	*49	*49	*49		
Consol. W. Dome L.	Toronto	*23	*22	*22⅜		
Cresson Consol. G.	N. Y. Curb	2⅛	2⅛	2⅛	De.31, Ja. 7	0.10
Crown Reserve	Toronto	*20	*17	*17⅛	Jan., 1917	0.05
Dome Mines	New York	18⅛	16⅛	18	De.31, Ja.20, Q	0.50
Golden Center	N. Y. Curb	1⅞	1⅜	1⅞		
Golden Cycle	Colo. Springs	†1.58	†1.57		No.30, Dec.10 Q	0.03
Hollinger Consol.	Toronto	19.00	18.90	18.92	Ja. 12, Ja. 28	0.08
Homestake Mining	New York	50	49	50	Ja.20, Ja.25 XM	1.50
Kirkland Lake	Toronto	1.25	1.11	1.25		
Lake Shore	Toronto	13.00	11.25	12.80	De.1,De.15 XQ	0.10
McIntyre-Porcupine	New York	24⅛	24	24⅛	Fe.1, Ma.7	0.05
Newray	Toronto	*42	*40⅛	*41⅜		
Night Hawk Pen.	Toronto	*10	*9	*10		
Noranda	N. Y. Curb	*16⅛	*15⅜	*16		
Portland	Colo. Springs	†*65	†*60		Oct., 1920	0.01
Rand Mines	New York	34⅛	34⅛	34⅛	Au.17, Au.25	1.52
Teck-Hughes	Toronto			3.65	Ja. 15, Fe. 1	0.05
Tom Reed	Los Angeles	*57½	*55	*57½	Ma.10 Ma. 20	0.02
Tough-Oakes	Toronto	*53	*48	*50		
United Eastern	N. Y. Curb			*45	July, 1924	0.05
Vipond Cons.	Toronto	1.98	1.91	1.97		
Wright-Hargreaves	Toronto	9.55	8.25	9.40	De.15, Ja. 1 QX	0.10
Yukon-Alaska Trust	N. Y. Curb	20½	20⅛	20⅛		
GOLD AND SILVER						
Carnegie Metals	Pittsburgh			16½		
Con. Cortez	N. Y. Curb			*6		
Con. Virginia	San Francisco	*29⅛	*20½	*20⅛		
Continental Mines	N. Y. Curb			*45		
Dolores Esperanza	N. Y. Curb	*76	*50	*50	July, 1923	0.05
Premier Gold	N. Y. Curb	2 3/16	2⅛	2⅛	De.18, Ja. 4	0.08
Tonopah Belmont	N. Y. Curb	4⅛	3⅛	3⅜	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	1⅛	1⅛	1⅛	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	6	5⅜	5⅞	Se.30, Oc.21	0.07½
Unity Gold	N. Y. Curb			*20		
West End Consol.	N. Y. Curb	*24	*24	*24	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*50	*50	*50	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb			1	Oct., 1920	0.50
Beaver Consol	Toronto	*85	*68	*84½	May. 1920	0.03
Castle-Trethewey	Toronto	1.67	1.59	1.60		
Coniagas	Toronto	4.10	4.00	4.10	May, 1924	0.12½
Keeley	Toronto	1.80	1.70	1.74	Ma. 1,Ma.15 X	0.12
Kerr Lake	N. Y. Curb	1⅛	1⅛	1⅛	Oc. 1, Oc.15 Q	0.12½
La Rose	Toronto	*35	*31½	*32	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1	1	1	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*22	*25	*22	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.50	3.47	3.49	Ja. 16, Ja.30	0.12½
Nipissing	N. Y. Curb	7	6¾	6⅞	De.31, Ja.2, Q	0.15
Temiskaming	Toronto	*14	*14	*14	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	8⅛	7⅛	8⅛	De.15,Ja.2, X	0.25
Alta Merger	Salt Lake	†4	†3½			
Bingham Mines	Boston	53⅛	52	53	De.19, De.20 Q	1.00
Cardiff M. & M.	Salt Lake	*55	*55	*55	De.16, No.18	0.10
Chief Consol.	Salt Lake			3.75	Fe. 1,	0.10
Emma Silver	Salt Lake	†1⅛	†1			
Erupcion	Boston Curb	1⅛	1⅛	1⅛	De.15, Ja.2, X	0.10
Federal M. & S.	New York	94	93	94		
Federal M. & S., pfd.	New York	93⅜	91⅛	93⅜	No.25, De.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*25	*18	*25		
Hecla Mining	N. Y. Curb	18	17⅛	17⅜	No.15, De.15 Q	0.50
Iron King Mining	Salt Lake	*30	*30	*30		
Keystone Mining	Salt Lake	*55	*53	*55	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*14	*13⅜	*14		
Mammoth Mining	Salt Lake	2.87½	2.85	2.85	De. 16, De. 23	0.10
Marsh Mines	Spokane	*10⅜	*9⅛	*9⅛	Se.15, Oc.1	0.15
Ontario Silver	New York			10		
Park Utah	Salt Lake	8.35	7.70	8.35	Se.15, Oc.1	0.15
Prince Cons	Salt Lake	*3⅛	*2⅛	*2⅛		
Silver King Coal	Salt Lake	9.35	9.30	9.35	De.15, Ja.2, QX	0.35
Silversmith	Spokane	*42	*38⅛	*39	De.31, Ja.10	0.02
Tamarack-Custer	Spokane	*58	*50	*56	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.37½	13.25	13.37½	De.16,De.23,QX	0.30
Utah-Apex	Boston	8⅛	7 1/16	8⅛	Ja.1, Ja.5, Q	0.35
Western Utah Copper	N. Y. Curb	*8	*8	*8		
IRON						
Bethlehem Steel	New York	47½	46½	47½	July, 1924	1.25
Colorado Fuel & Iron	New York	36⅛	34⅛	35⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	26⅜	25⅞	26⅜	De. 4, De. 28,	0.75
Inland Steel	New York	41⅞	40	40	Fe.15, Ma.1 Q	0.62½
Mesabi Iron	N. Y. Curb	2	2	2		
Replogle Steel	New York	14⅛	13⅜	13⅞		
Republic I. & S.	New York	59⅜	56⅛	57⅜	May, 1921	1.50
Republic I. & S. pfd.	New York	94	93	94	Ma.15, Ap.1, Q	1.75
Sloss-Sheffield S. & I.	New York	126	122¼	125½	De.10, Dc.21 Q	1.50
Sloss-Shef. S.&I. pfd.	New York			102	De.21, Ja.2, Q	1.75
U. S. Steel	New York	135½	132½	133⅞	Fe.27, Ma.31 XQ	1.75
U. S. Steel pfd.	New York	127⅛	125⅜	125⅜	Fe. 3, Fe. 27, Q	1.75
Virginia I. C. & C.	New York	43	43	43	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York			77	De.15, Ja.2,	2.50
VANADIUM						
Vanadium Corp.	New York	32⅜	30½	32½	Fe.1, Fe.15, Q	0.50
ASBESTOS						
Asbestos Corp.	Montreal	90½	88⅛	90	De.31, Ja.15 Q	1.50
Asbestos Corp., pfd.	Montreal	115½	113	114	De.31, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	24⅞	22	23½	Nov., 1919	1.00
Texas Gulf	New York	127½	122½	126½	De.1, De.15,QX	2.75
DIAMONDS						
De Beers Consol.	New York	29	29	29	Ja.26, Fe.2	0.23
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4	4	4		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	54⅛	52	54	Fe.18, Ma. 1, Q	1.00
Amer. Metal pfd.	New York	115	115	115	Fe. 19, Ma. 1, Q	1.75
Amer. Sm. & Ref.	New York	140⅛	132⅛	139⅛	Ja.15, Fe.1,	1.75
Amer. Sm.&Ref.pfd.	New York	117½	115½	117½	Fe.5,Ma.1, Q	1.75
Consol. M. & S.	N. Y. Curb	199	199	199	De.31, Ja.15	0.75
Federated Metals	N. Y. Curb	22	21⅛	21⅛		
Newmont Mining	N. Y. Curb	53⅛	52	53	De.31, Ja.15,	0.60
Southwest Metals	N. Y. Curb			2		
U. S. Sm. R. & M.	New York	46⅜	45⅛	46⅛	Ja.1, Ja.7, Q	0.87½
U.S. Sm. R.&M.pfd.	New York	49⅛	48⅜	49	Ja.1, Ja.7, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and Henry Sachs; Colorado Springs, Colo.

LONDON QUOTATIONS, WEEK ENDED JANUARY 16, 1926

	High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)	82/6	80/—	80/—	Nov. 1925	5(c)
British Platinum	7/7½	6/6	7/6	Feb. 1925	2½
Burma Corpn. (10 rupees)	19/1½	18/6	18/7½	Feb. 1926	6 annas.*
Bwana M'Kubwa	8/3	7/10½	8/—		
Camp Bird	5/3	4/6	5/1½		
El Oro	5/7½	5/9	6/6	Nov. 1924	2½*
Esperanza	—/10	—/7½	—/9		
Frontino & Bolivia	8/4½	7/6	8/—	Jan. 1926	1½
Mexican Corporation	23/3	21/9	22/9		
Mexican Mines of El Oro	32/6	29/4½	32/6	Dec. 1925	12½*
Nechi (pref. 10s.)	1/6	1/—	1/3	1921-22	25
Oroville Dredging	4/—	3/9	4/—	Dec. 1923	3⅛
Ouro Preto	2/9	2/6	2/6	May 1925	2½
St. John del Rey	10/10½	10/4½	10/6	June 1925	6½
San Francisco Mines	31/9	30/6	31/3	Jan. 1926	22½
Santa Gertrudis	22/7½	21/6	22/—	July 1920	5
Selukwe (2s. 6d.)	12/4½	11/4½	11/10½	April 1917	6¾
S. American Copper	5/3	4/10½	5/3	Nov. 1917	75
Tanganyika	48/3	43/9	45/—	Sept. 1925	5
Tomboy	4/9	4/6	4/6	Sept. 1925	5
Union Minière du Haut-Katanga (Brussels) 100 Fr.	6.670	6.515	6.680	July 1925	150(b)

* Free of British income tax. (b) Belgian francs. (c) Swiss francs.